Handbook

Structural Repair Instructions

NAVY MODELS

R3Y-1 AND R3Y-2 AIRPLANES

THIS PUBLICATION REPLACES AN 01-5MR-3 DATED 15 MARCH 1955

PUBLISHED UNDER AUTHORITY OF THE SECRETARY OF THE AIR FORCE AND THE CHIEF OF THE BUREAU OF AERONAUTICS

15 February 1957

LIST OF REVISED PAGES ISSUED

BuAer

ADDITIONAL COPIES OF THIS PUBLICATION MAY BE OBTAINED AS FOLLOWS:

USAF ACTIVITIES.—In accordance with Technical Order No. 00-5-2.

NAVY ACTIVITIES.—Submit request to nearest supply point listed below, using form NavAer-140; NASD, Philadelphia, Pa.; NAS, Alameda, Calif.; NAS, Jacksonville, Fla.; NAS, Norfolk, Va.; NAS, San Diego, Calif.; NAS, Seattle, Wash.; ASD, NSC, Guam.

For listing of available material and details of distribution see Naval Aeronautics Publications Index NavAer 00-500.

TABLE OF CONTENTS

Par. No.		Page No.
	LIST OF ILLUSTRATIONS	ii
	INTRODUCTION	iv
	SECTION I. GENERAL	1
1-1	Description	1
1-4	Construction	1
1-6	Function	1
1-8	Flight Forces	1
1-10	Stresses	1
1-17	Factors Affecting Strength of Members	6
1-21	Investigation of Damage	7
1-31	Support of Structure During Repair	8
1-34	Alignment	8
1-36	Classification of Damage and Types of Repair	8
1-42	Materials Used in Fabricating Repair and Replacement Parts	16
1-47	Fastener Information	18
1-57	Design Principles of Structural Repairs	25
1-71	Corrosion Resistant Steel	36
1-75	Fiberglas	36
1-78	Dissimilar Metals	37
1-81	Control Surface Balance	37
1-88	Major Components	39
	SECTION II. WING GROUP	41
2-1	General	41
2-2	Wing Interspar Structure	41
2-12	Fuel Tank Maintenance	50
2-49	Leading Edge	57
2-56	Trailing Edge	59
2-63	Wing Tip	59
2-66	Wing Flaps	61
2-73	Aileron and Tabs	63
2-83	Auxiliary Float Assembly	63
	SECTION III. TAIL GROUP	69
3-1	General	69
3-2	Dorsal Fin	69
3-9	Vertical Stabilizer	69
3-29	Horizontal Stabilizer	75
3-38	Movable Tail Components	77
	SECTION IV. BODY GROUP	81
4-1	Hull Assembly	81
4-6	Hull Construction	81
	SECTION V. ALIGHTING GEAR	109
	SECTION VI. NACELLE GROUP	111
6-1	Nacelles	111
	SECTION VII. FABRIC REPAIR AND ATTACHMENT	117
	SECTION VIII. EXTRUDED SECTIONS AND ROLL-FORMED SECTIONS	117
8-1	Extrusions	117
8-6	Roll-Formed Sections	135
	APPENDIX I. REPAIR MATERIALS	155
	APPENDIX II. TYPICAL REPAIRS	161

LIST OF ILLUSTRATIONS

Figure	Title	Page
1-1	Three View Drawing (Sheet 1)	2
1-1	Three View Drawing (Sheet 2)	3
1-1	Three View Drawing (Sheet 3)	4
1-2	Flight Forces	5
1-3	Difference Between Stress and Strain	5
1-4	Tension Stress	5
1-5	Compression Stress	5
1-6	Shear Stress	5
1-7	Torsion Stress	5
1-8	Bending Stress	6
1-9	Secondary Effect of Damage	6
1-10	Typical Spar Elements	7
1-11	Jacking and Hoisting	9
1-12	Wing Guard Rail and Aileron Batten	10
1-13	Wing Leading Edge Work Platform	11
1-14	Rudder and Elevator Battens	12
1-15	Outer Wing Panel and Horizontal Stabilizer Sling	13
1-16	Rigging Diagram	14
1-17	Leveling Provisions	15
1-18	Huck Lockbolt Installation	19
1-19	Huck Lockbolt Removal	20
1-20	Hi-Shear Rivet Installation	21
1-21	Flush Rivet Installation (Sheet 1)	22
1-21	Flush Rivet Installation (Sheet 2)	23
1-21	Flush Rivet Installation (Sheet 3)	24
1-22	Rivet Length Required When Grip Is Known	25
1-23	Minimum Spacing Rivet Patterns	32
1-24	Rectangular Plating Repairs	33
1-25	Round Plating Repairs	34
1-26	Extruded Structural Member Splice	35
1-27	Balancing Control Surfaces	38
1-28	Major Components	40
2-1	Wing Components	42
2-2	Wing Stations	43
2-3	Wing Center Section Interspar Structure	44
2-4	Wing Outer Panel Interspar Structure	45
2-5	In-Flight Refueling Pod Wing Spar Components, Typical (Sheet 1 of 2)	46
2-5	In-Flight Refueling Pod Wing Spar Components, Typical (Sheet 2 of 2)	47
2-6	Wing Stringer Diagram	48
2-7	Wing Plating Diagram	49
2-8	Installation of Fittings and Fasteners in a Fueltight Area	51
2-9	Overcoating of Platenuts and Concealed Rivets	52
2-10	Installation of Huck Lockbolts and AN Bolts in Fueltight Areas	53
2-11	Fuel Leak Stain Pattern	54
2-12	Wing Leading Edge Structure	58
2-13	Wing Trailing Edge Structure	60
2-14	Wing Tip Structure	61
2-15	Wing Flap Structure and Plating	62
2-16	Aileron and Tab Structure and Plating	64
2-17	Auxiliary Float and Strut Structure	65
2-18	Auxiliary Float Stations	66
2-19	Auxiliary Float Plating	67
3-1	Tail Group Components	70
3-2	Tail Group Stations	71
3-3	Tail Group Plating	72
3-4	Dorsal Fin Structure	73
3-5	Vertical Stabilizer Structure	74
3-6	Horizontal Stabilizer, Elevator and Tab Structure	76
3-7	Horizontal Stabilizer Stringer Diagram	77
3-8	Rudder and Tab Structure	78
4-1	Hull Station Diagram (Sheet 1)	80
4-1	Hull Station Diagram (Sheet 2)	82
4-2	Hull Structure (Sheet 1)	83
4-2	Hull Structure (Sheet 2)	84
4-2	Hull Structure (Sheet 3)	85
4-2	Hull Structure (Sheet 4)	86
4-2	Hull Structure (Sheet 5)	87
4-3	Hull Stringer Diagram (Sheet 1)	88
4-3	Hull Stringer Diagram (Sheet 2)	89
4-3	Hull Stringer Diagram (Sheet 3)	90
4-3	Hull Stringer Diagram (Sheet 4)	91
4-3	Hull Stringer Diagram (Sheet 5)	92
4-4	Hull Plating Diagram (Sheet 1)	94
4-4	Hull Plating Diagram (Sheet 2)	95
4-4	Hull Plating Diagram (Sheet 3)	96
4-4	Hull Plating Diagram (Sheet 4)	97
4-4	Hull Plating Diagram (Sheet 5)	98
4-5	Hull Frame Repair	99
4-6	Hull Bottom Repair (Sheet 1)	100
4-6	Hull Bottom Repair (Sheet 2)	101
4-6	Hull Bottom Repair (Sheet 3)	102

LIST OF ILLUSTRATIONS (Cont'd)

Figure	Title	Page
4-7	Sandwich Type Floor Panel Repair	104
4-8	Side Cargo Door Frame and Seal Repair	105
4-9	Bow Cargo Door and Loading Ramp Structure	106
4-10	Bow Loading Ramp Repair	108
6-1	Nacelle Components and Plating	110
6-2	Nacelle Structure	112
6-3	Nacelle Stations	113
6-4	Nose Section Upper Longeron Repair	114
8-1	Angle 90°—Equal Flange Width and Thickness	118
8-2	Angle 90°—Unequal Flange Width—Equal Thickness	119
8-3	Angle 90°—Unequal Flange Width and Thickness	120
8-4	Angle—Acute	120
8-5	Angle—Obtuse	121
8-6	"T"—Unequal Flange Thickness	121
8-7	"T"—Plain (Sheet 1)	122
8-7	"T"—Plain (Sheet 2)	123
8-8	"T"—Flanged	124
8-9	Channel—Plain	125
8-10	"I" Section	125
8-11	"Z"—Plain	126
8-12	"Z"—Unequal Flange Width and Thickness	127
8-13	Special Extruded Shapes (Sheet 1)	128
8-13	Special Extruded Shapes (Sheet 2)	129
8-13	Special Extruded Shapes (Sheet 3)	130
8-13	Special Extruded Shapes (Sheet 4)	131
8-13	Special Extruded Shapes (Sheet 5)	132
8-13	Special Extruded Shapes (Sheet 6)	133
8-13	Special Extruded Shapes (Sheet 7)	134
8-13	Special Extruded Shapes (Sheet 8)	135
8-14	Angle 90°—Plain (Sheet 1)	138
8-14	Angle 90°—Plain (Sheet 2)	139
8-15	Angle 90°—Equal Leg—Flanged	140
8-16	Angle 90°—Equal Leg—One Leg Flanged	141
8-17	Angle 90°—Unequal Leg—One Leg Flanged (Sheet 1)	142
8-17	Angle 90°—Unequal Leg—One Leg Flanged (Sheet 2)	143
8-18	Angle 90°—Unequal Leg (Sheet 1)	144
8-18	Angle 90°—Unequal Leg (Sheet 2)	145
8-19	Angle 90°—Unequal Leg—Flanged	146
8-20	Channel—Plain	147
8-21	Y11—Channel—Unequal Leg Y12—Channel—Flanged	148
8-22	Y13—Angle—Curved Leg—Flanged Y14—Channel—Square—Flanged	149
8-23	Y20—Hat—Rectangular—Flanged Y31—Hat—Pyramid—Plain Y32—Hat—Rectangular—Plain	150
8-24	Y33—"Z"—Plain Y34—"Z"—One Leg Flanged	151
8-25	Y36—"Z"—Flanged (Sheet 1)	152
8-25	Y36—"Z"—Flanged (Sheet 2)	153
8-26	Y50—Finish Strip—Bulb Type 3-16870—Finish Strip—Channel	153
8-27	Corrosion Resistant Steel Formed Members	154
B-1	Typical Stressed Plating Repairs	162
B-2	Typical Extruded Member Splices (Sheet 1)	163
B-2	Typical Extruded Member Splices (Sheet 2)	164
B-3	Typical Formed Member Splices	165
B-4	Single Flange Repair—Rib or Structural Member	166
B-5	Formed Rib Flange and Web Repair	167
B-6	Flange and Web Repair at a Lightening Hole	168
B-7	Cracked Dimple Repairs—24ST Under 0.040 Gage	169
B-8	Cracked Dimple Repairs—75ST Under 0.040 Gage	170
B-9	Typical Trailing Edge Repair	171
B-10	Leading Edge Repair—Exhaust Duct Area	172
B-11	Leading Edge Repair—"D" Duct Area	173
B-12	Leading Edge Repair at the Forward Baffle	174
B-13	Corrosion Resistant Steel Leading Edge Rib Repair	175

INTRODUCTION

This handbook is published to aid service personnel in the inspection, evaluation and design of repairs for damages which may occur during the operation of R3Y-1 and R3Y-2 airplanes. Unless specifically noted otherwise, information contained in it shall be considered pertinent to both models. The principles of repair and typical repairs are emphasized, rather than specific repairs. By applying these principles, repairs may be designed by field personnel which will be satisfactory for most of the damages occurring in normal operation. Extensive damage to primary structure will require individual engineering action.

Section I deals with evaluation of damage, establishes repair methods, and describes repair materials. Sections II to VI describe the individual components of the airplane, call attention to points of special importance and prescribe repairs for particular types of structure found in each area. Specific repairs of assumed damage are located in the section to which they are applicable. Typical repairs which are applicable to elements found in more than one component are grouped in Appendix II. Section VIII is devoted to a listing and description of the extruded and roll formed structural members used in the construction of these airplanes. A list of materials required to fabricate the repairs described in this handbook as well as repair and replacement vendor items for which a need might be anticipated is contained in Appendix I. Specifications of these items are contained in this appendix in lieu of calling them out repeatedly in the text of the preceding sections.

SECTION I

GENERAL

1-1. DESCRIPTION.

1-2. GENERAL. (See figure 1-1.) The R3Y-1 is a long range flying boat with a maximum gross takeoff weight of 175,000 pounds. Four Allison T40-A-10 turbine propeller engines developing 5500 hp each, power the airplane. A contra-rotating propeller is installed on each engine. Fixed auxiliary floats are installed on the underside of each wing outboard of the outboard nacelles. Each wing also has provisions for the optional mounting of two in-flight refueling pods, to permit in-flight refueling of short range aircraft engaged in extended overwater flights. The cabin is pressurized and designed to transport either troops or cargo or a combination of both. The boat-shaped hull provides alighting facilities and no landing gear is installed.

1-3. The R3Y-2 is basically the same as the R3Y-1 except for the hull forward of bulkhead 4.0 and the location, size and arrangement of the flight operations deck. The R3Y-2 incorporates a large bow cargo door and an integral loading ramp, permitting direct line loading and unloading of troops and/or equipment. Its general purposes are the same but its utility as a cargo carrier is greater.

1-4. CONSTRUCTION.

1-5. GENERAL. The primary structure is aluminum alloy interior framework with stressed skin of alclad. It is fabricated by riveting, with high strength fasteners used extensively in heavier parts of the structure. Corrosion resistant steel is used for thermal anti-ice leading edge, fire curtains, and other high temperature parts. Fiberglas cloth reinforced plastic materials are used as insulators, fairings, and as covers for radio antennas. A large portion of the structure is sealed for air, water, or fuel tightness by special design features and the incorporation of sealants. A further description of the structure of individual components is found in the applicable section.

1-6. FUNCTION.

1-7. GENERAL. The primary purpose of R3Y-1 and R3Y-2 airplanes is to transport personnel or supplies at high speeds and to operate from water bases; the special version configuration provides in-flight refueling for short range airplanes engaged in extended overwater flights. Due to the mediums and speed ranges in which they operate, it is highly important that structural failures be held to a minimum. These airplanes have been designed with the aim to make each part strong enough to carry the load imposed on it with a predetermined margin of safety but not be over strength —this would increase its weight. For this reason it is very important that any damaged structural part be repaired to return it to original strength. The importance of the damage, and the repair to be made, will require individual decision after a thorough inspection and evaluation. The first inspection and evaluation will generally be conducted by field personnel and a decision made as to whether it is negligible, must be repaired but will not interfere with flight, must be repaired before flight, can be repaired by employing information found in this handbook, or will require special engineering action. An understanding of the forces acting on an airplane and the consequent stresses set up in the structure by them, will help in arriving at these decisions.

1-8. FLIGHT FORCES.

1-9. GENERAL. There are four forces working on an airplane in normal flight. They are lift, gravity, thrust, and drag. If an airplane is to accelerate, take off, and climb, thrust must overcome drag and lift must overcome gravity. To maintain a constant speed and altitude, thrust must be equal to drag and lift must be equal to gravity. (See figure 1-2.)

1-10. STRESSES.

1-11. GENERAL. The action of these forces on the airplane set up stresses in the structure. Do not confuse stress and strain. Stress is a condition which is set up

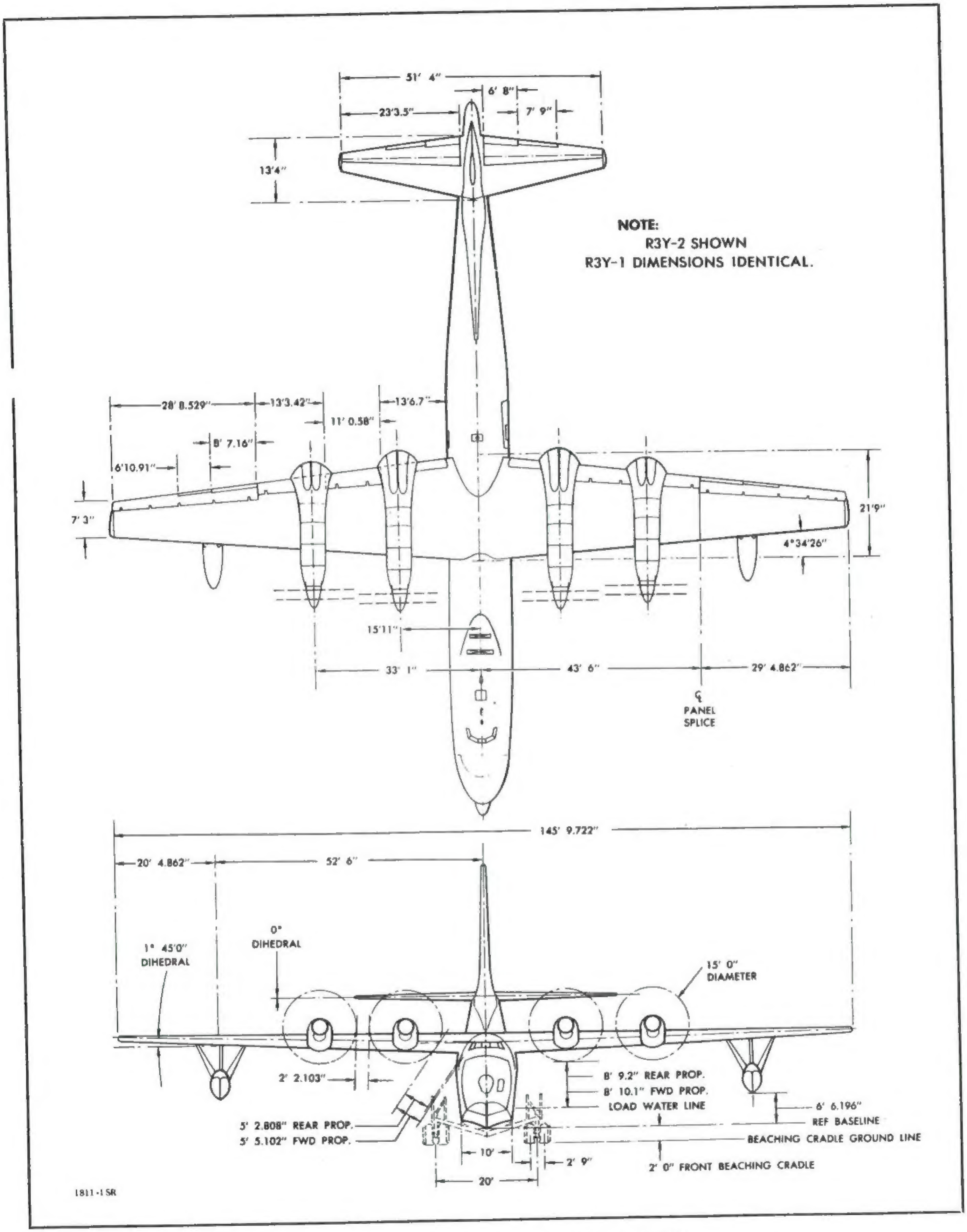


Figure 1-1. Three View Drawing (Sheet 1 of 3)

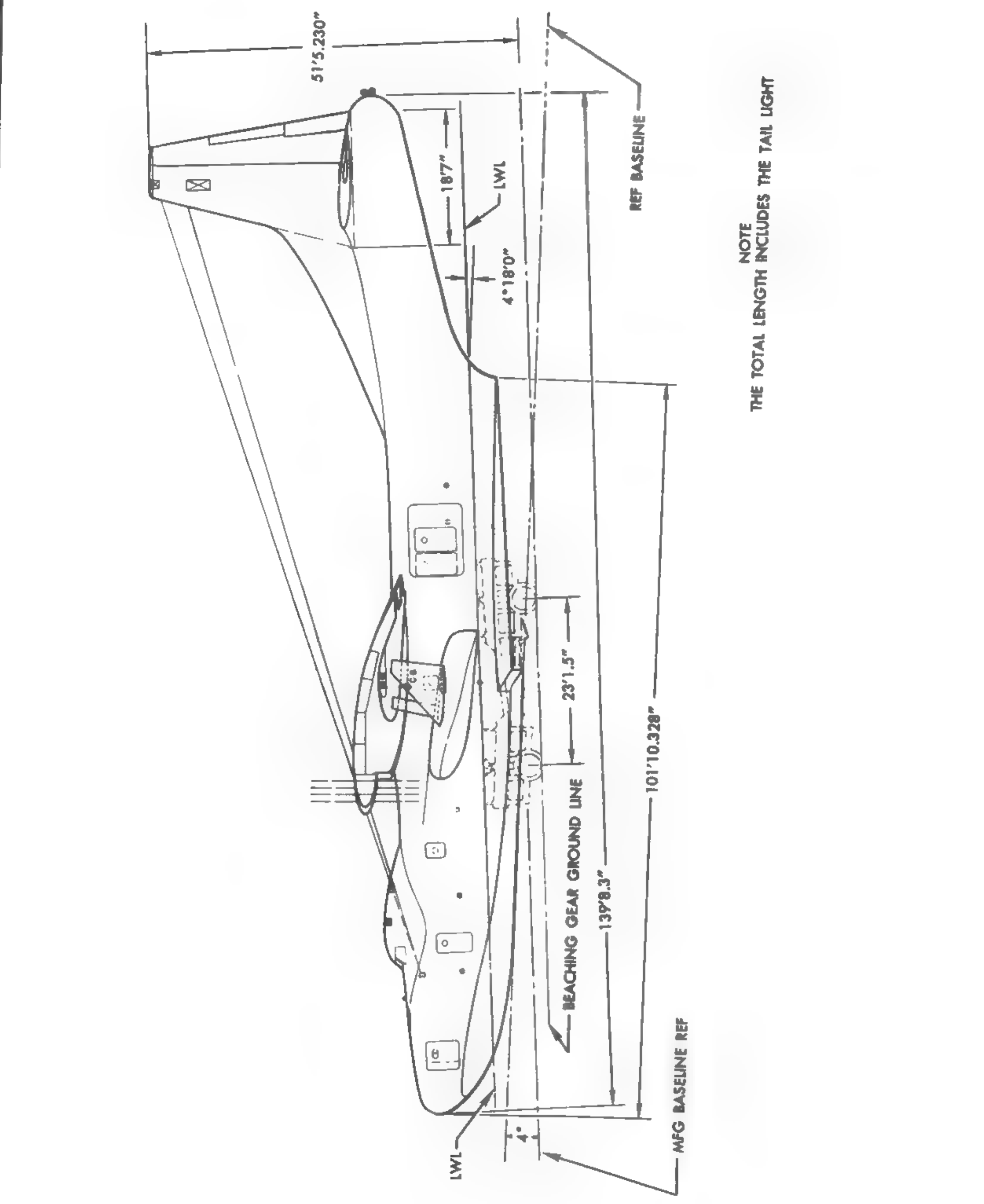


Figure 1-1. Three View Drawing (Sheet 2 of 3)

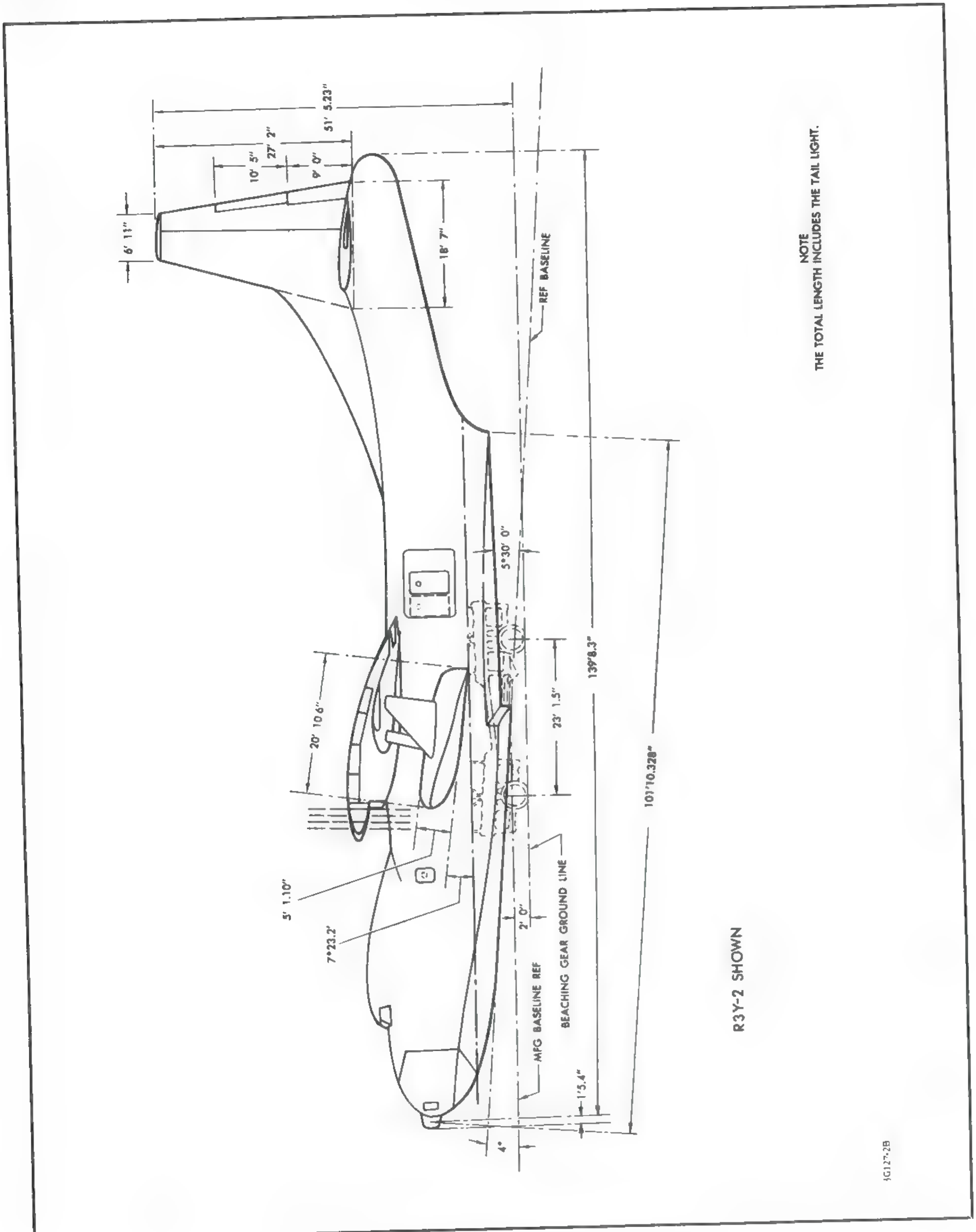


Figure 1-1. Three View Drawing (Sheet 3 of 3)

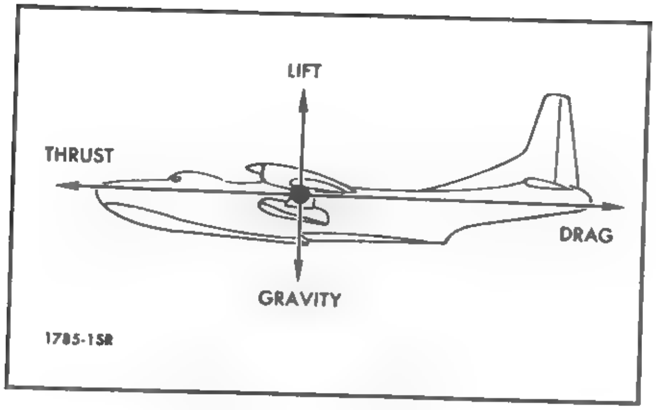


Figure 1-2. Flight Forces

in a member to which a force is applied. It is given a value of pounds per square inch and is equal to the applied force divided by the cross sectional area of the member in square inches. Strain is deformation of a member due to the stress within it and is given a value of length, thickness or movement; see figure 1-3. There are five stresses to be considered in designing a repair. They are tension, compression, shear, torsion, and bending. The first three are basic stresses. Torsion is a type of shear—bending is a combination of stresses often set up by only one force.

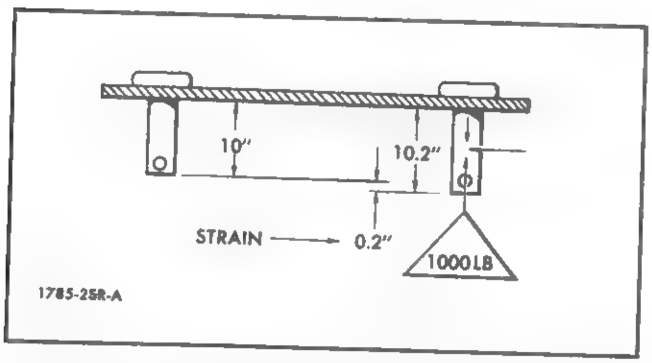


Figure 1-3. Difference Between Stress and Strain

1-12. TENSION. Tension stress is found in a member on which a force is applied which tends to stretch or elongate the member; see figure 1-4.

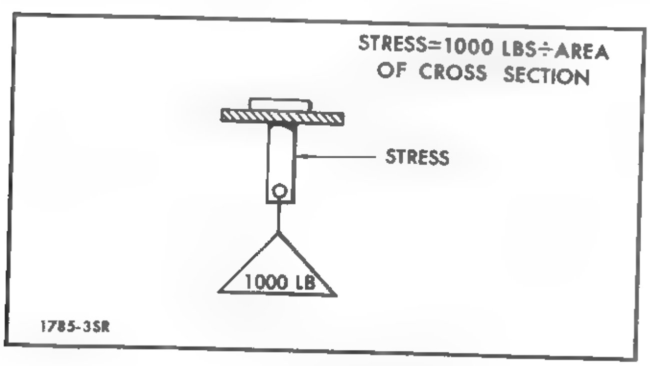


Figure 1-4. Tension Stress

1-13. COMPRESSION. Compression stress is found in a member on which a force is applied which tends to shorten or crush the member; see figure 1-5.

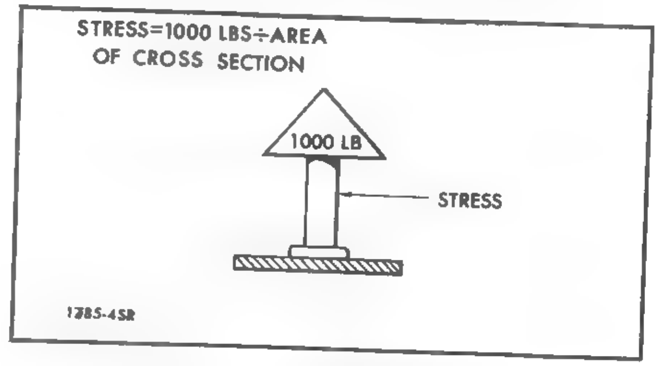


Figure 1-5. Compression Stress

1-14. SHEAR. Shear stress is found in a member on which a force is applied which tends to move or slide one portion of the member past an adjacent portion; see figure 1-6.

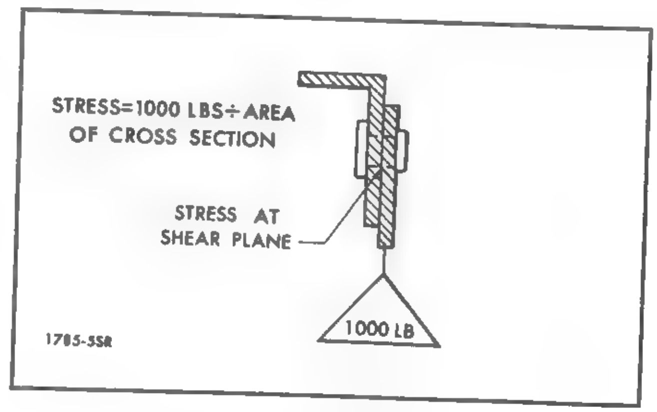


Figure 1-6. Sheer Stress

1-15. TORSION. Torsion stress is found in a member on which a force is applied which tends to twist or turn one portion of the member in relation to an adjacent portion; see figure 1-7.

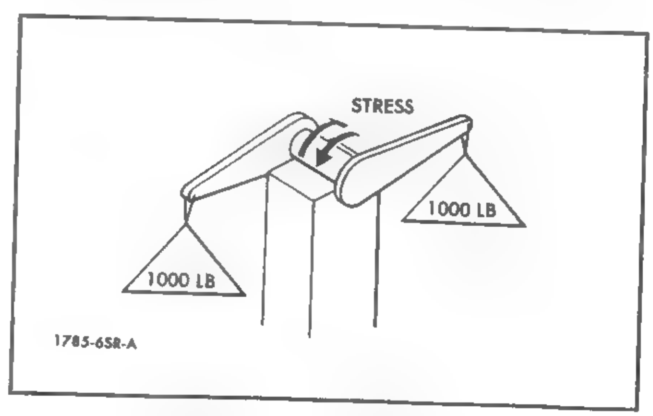


Figure 1-7. Torsion Stress

1-16. BENDING. Bending stress is found in a member on which a force is applied which tends to bend, deform or change the shape of the member. When analyzed, it is found that the resistance to bending is a combination of tension, compression, and shear; see figure 1-8.

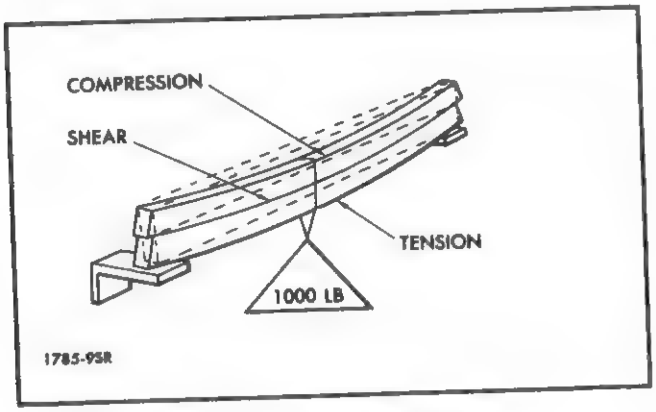


Figure 1-8. Bending Stress

1-17. FACTORS AFFECTING STRENGTH OF MEMBERS.

1-18. GENERAL. The stresses which can safely be developed in a member are dependent on three factors: cross-sectional area, shape, and material. The strength of a member in tension is dependent on cross-sectional area and material only. The same holds true for compression in very short members. As length of the member increases, the shape becomes more important. The strength of a member in torsion is very dependent on shape—a cylinder or tube being the strongest. Resistance to bending involves a combination of stresses and is highly dependent on the shape of the member as well as cross-sectional area and material. The shape, cross-sectional area, and material of structural members used in these airplanes have been chosen to produce as strong and light a structure as possible and at the same time meet aerodynamic and production requirements. Consequently, it is very important that any repair return the structural member involved as nearly as possible to its original shape and material—any loss of strength due to change of shape must be compensated by an increase in cross-sectional area.

1-19. EFFECT OF STRAIN BEYOND ELASTIC LIMIT. When evaluating damage, another characteristic of structural members should be understood. When a force is applied to a member, stresses are set up in it which resist the force but result in a strain or deformation of the member. If this strain does not exceed the elastic limit or yield point, the member will return to its original shape when the force is removed. If the member does not return to its original shape, the strain has exceeded its elastic limit and a permanent set has been taken by the member. Generally, the member will be capable of standing re-application of the same force without further yielding. The main things to consider are whether the deformation will interfere with its normal function and whether the change in its shape will cause it to fail when a difficult force is applied. (See figure 1-9.)

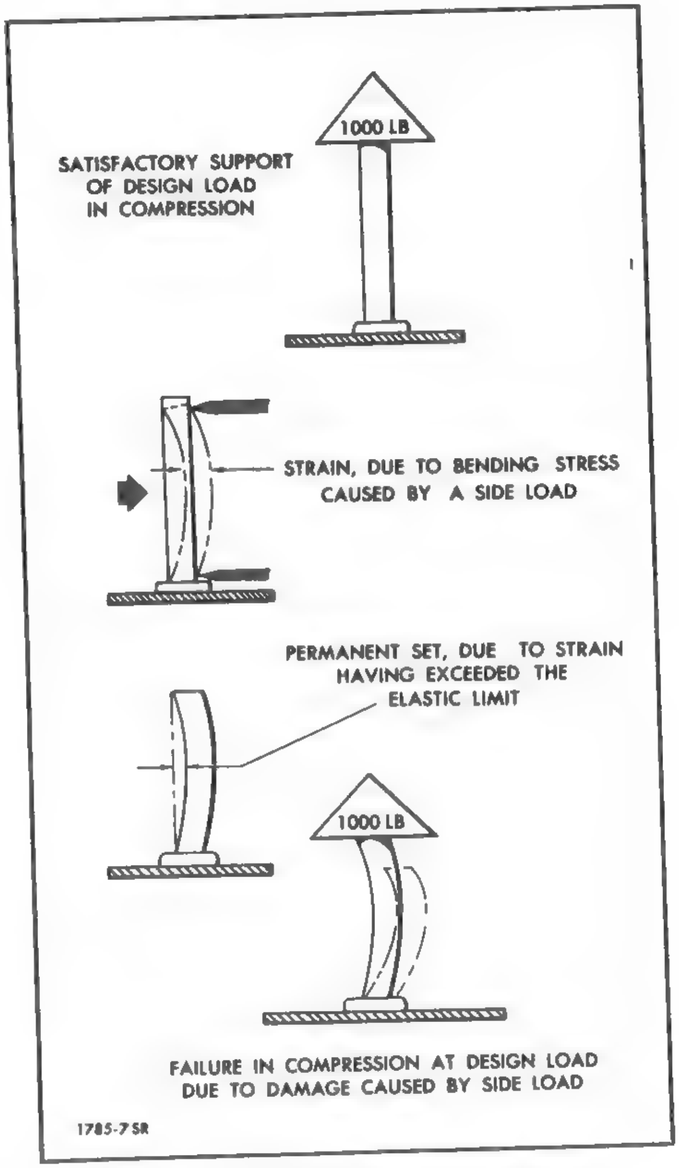


Figure 1-9. Secondary Effect of Damage

1-20. IMPORTANCE OF DAMAGE DUE TO LOCATION. When a force is applied which tends to bend a member, stresses of tension, compression, and shear are set up in it as shown in figure 1-8. The stresses are greatest in the parts of the member farthest from its center. For this reason, spars are built with the greater part of their cross-sectional area at the edges. These reinforced sections are called rails or flanges. Because of this concentration of stresses, these rails or flanges are the points where the least damage can be tolerated;

see figure 1-10. As extruded structural members used as stringers and stiffeners are subjected to bending forces, care should be used in the size and location of rivet holes drilled in the flanges. Holes drilled by the manufacturer are the best guide for the mechanic. Remember, a member loses a portion of its cross-sectional area when a hole is drilled in it. If a rivet is properly installed, the strength of the member in compression is largely returned—however, its strength in tension is still reduced. These factors should be considered in evaluating damage and planning repairs.

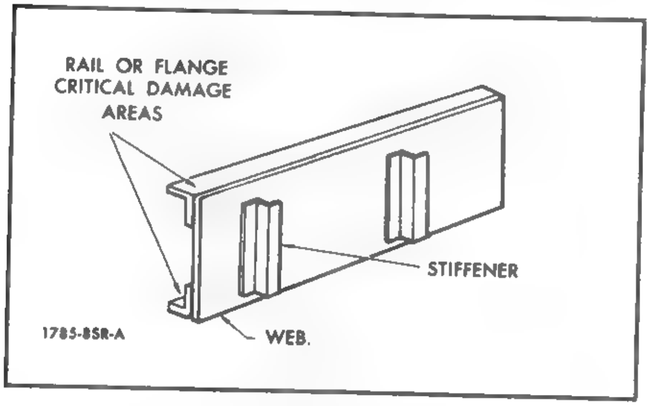


Figure 1-10. Typical Spar Elements

1-21. INVESTIGATION OF DAMAGE.

1-22. GENERAL. Inspection and evaluation are very important items in maintenance, therefore, a thorough understanding of when and where to inspect and what to look for will be a great help to field personnel. It is the purpose of the following paragraphs to establish principles and relate them to these airplanes.

1-23. WHEN TO INSPECT. After a report of suspected possible damage or of unsatisfactory performance; all information regarding damage or unsatisfactory performance should be obtained from personnel initiating the report. Find out where the damage may be located or the symptoms that caused a report of poor performance. When the damaged area is located it should be inspected thoroughly. Any area that could be strained or damaged in conjunction with the original damage should also be inspected. At routine inspection intervals the entire airplane should be thoroughly checked. The procedure for such a check should be followed carefully. An item found to be unsafe or in an unsafe condition should be repaired or replaced. Visual checks should be made of the airplane before, after, or in flight, while moored, and during general work times.

1-24. CAUSES OF DAMAGE.

a. Impact Damage.

When: May occur at almost any time.

Where: Hull bottom during handling, take off and landing. Leading parts of all components while in flight. Any area where work is being accomplished.

What: Scratches, dents, tears. Always check for internal damage such as misalignment of parts, loose, tilted or sheared rivets, or cracks in attachment fittings due to transmitted stress.

b. Stress Damage.

When: During flight, water handling, or when moored in high wind when abnormal loadings may be imposed on the structure.

Where: May occur at any point along the force-flow path between the point of loading and the center of mass of the airplane, such as stiffeners, bulkheads, stringers, longerons, spars, and fittings.

What: First evidence will be wrinkled skin and loose or tilted rivets. Check for misalignment of parts, torn out or sheared fasteners, and deformed or broken fittings.

c. Fatigue Damage.

When: This type of damage occurs with more frequency as time accumulates in service. It is usually discovered on routine inspections. Experience is the best guide as to when the inspections should be made.

Where: At points subjected to vibration, flexing and reversal of loads. Particularly light skins, fittings, and any point on load bearing members where fittings attach or the cross section changes abruptly, are subject to this damage.

What: Generally starts as a crack at a rivet or bolt hole. Careful inspection is required to locate while still small and before failure occurs.

d. Corrosion Damage.

When: This action is taking place to some extent at all times. Inspect at regular intervals and at any time an area is open for other work. Attempt to arrest the action before replacement is necessary.

Where: Any exposed aluminum alloy, magnesium, or steel surface and at any point where dissimilar metals are in direct contact and moisture is present. Areas where salt water can reach are specially affected.

What: A white, salt-like deposit on aluminum alloys, accompanied by pitting of the metal. Red rust on steel surfaces. Corrosion may work under a paint surface and be evident by scaling and blistering of the paint.

1-25. LOCATION OF DAMAGE. The location of a damaged part is a prime factor in the evaluation of its importance. That which might be classed as negligible at one point may be of prime importance at another. Factors which must be considered in this evaluation are structural strength, function, shape, and operation of parts.

1-26. STRUCTURAL STRENGTH. Any damage along normal "force-flow" paths is always important. These paths can be visualized and traced. A force applied to an aileron control tab will be transmitted in

turn to its hinges, aileron and its hinges and supports, wing interspar structure, wing-to-hull attachment fasteners, and hull bulkheads. Members designed to carry these loads constitute the primary structure of the airplane. In this airplane, the skin along these "force-flow" paths is also stressed and is part of the primary structure. Any change in shape (dents or bends), or cross section (holes, nicks, or cracks), affect the load bearing ability of the structure, and the nearer the center of mass of the airplane the greater the importance.

1-27. SPECIAL FUNCTIONS. A small hole in the skin will have varying importance, depending on location. In fairings, trailing edge and aft section of the hull it would be unimportant. In the pressurized section of the hull it would be important when flying at altitude. In the hull bottom it would be important when on the water or when flying at altitude. In the thermal anti-ice leading edge it would be very important only when flying under icing conditions. The same size hole in a fuel tank might lead to the destruction of the airplane.

1-28. AERODYNAMIC SHAPE. Damage which changes the shape of parts of the airplane also may vary in importance with location. The most important locations are the forward part of the wing, the control surfaces and any damage which might cause misalignment of any of the airfoil surfaces.

1-29. OPERATION. Operate all movable parts which might be affected by the known or suspected damage. Binding or irregular motion may indicate a hidden distortion or failure. Check the rigging of the parts.

1-30. REPAIR. When the full extent of damage is determined, make a survey of time, cost and availability factors to determine whether to repair or replace the damaged part. A repair must meet the following requirements:

a. The repaired structure must be equal or greater in strength than the original. Repairs of fatigue type failures especially should be stronger than the original to preclude the possibility of recurrence.

b. The repaired structure must perform its special function, such as fuel, water or air tightness.

c. If external, it must conform as nearly as possible to the original aerodynamic shape. If a supporting member, the rigging of the involved parts must conform to specifications.

d. It must not interfere with or restrict the operation of any moving part.

e. Normal precautions against corrosion must be observed, such as priming of faying surfaces and insulating dissimilar metals.

1-31. SUPPORT OF STRUCTURE DURING REPAIR.

1-32. GENERAL. A major part of the hull can be worked on while supported by the beaching cradle. If the beaching cradle needs to be removed for work on the hull, the airplane can be supported on jacks. Figure 1-11 lists equipment for jacking and hoisting the airplane and components, with attachment points indicated. Figures 1-12, 1-13, 1-14, and 1-15 show other tools used during accomplishment of structural repairs.

1-33. At the present time there are no special stands designed to support the various components of the airplane during repair. For everyday operations keep in readiness an adequate number of sawbucks and pad them with small bags filled with sand. The sand bags may measure about 8 inches by 12 inches with parallel seams running widthwise every two inches so the sand easily conforms to the contour of an object placed upon it: Lengthwise the sand will more or less hold its position because of the boundary formed by each pair of seams. On trailing edges, the danger of shearing and twisting is avoided provided one separate support is furnished for every three feet of length, and in the case of an aileron, elevator or a leading edge section, one support for every five feet of length. Apply supports at bulkheads, frames, or ribs only.

1-34. ALIGNMENT.

1-35. GENERAL. Manufacturing tolerances for alignment of major components of the airplane are shown in figure 1-16. Alignment should be checked after major repair or replacement of major components. Direct measurement by use of a steel tape is an approximate method which permits a rapid appraisal after an accident or major repair. If any distortion is indicated by this check, recheck by means of a transit sight level with the airplane on jacks and accurately leveled. Level attitude, both longitudinal and lateral, may be checked by means of a plumb line attached to a bracket and read on a scale provided in the aft section of the hull. A fitting is also provided to aid in establishing hull inch stations. It is at hull inch station 1500.50 and so located that the plumb line may be projected through the warm-up fitting access door for external measurements. (See figure 1-17.)

NOTE

The airplane must be level longitudinally before taking measurements from the station location plumb line.

1-36. CLASSIFICATION OF DAMAGE AND TYPES OF REPAIR.

1-37. GENERAL. The four classifications of damage are:

a. Negligible damage.

b. Damage repairable by patching.

c. Damage repairable by insertion.

d. Damage necessitating replacement of parts.

All four situations may exist due to one general failure.

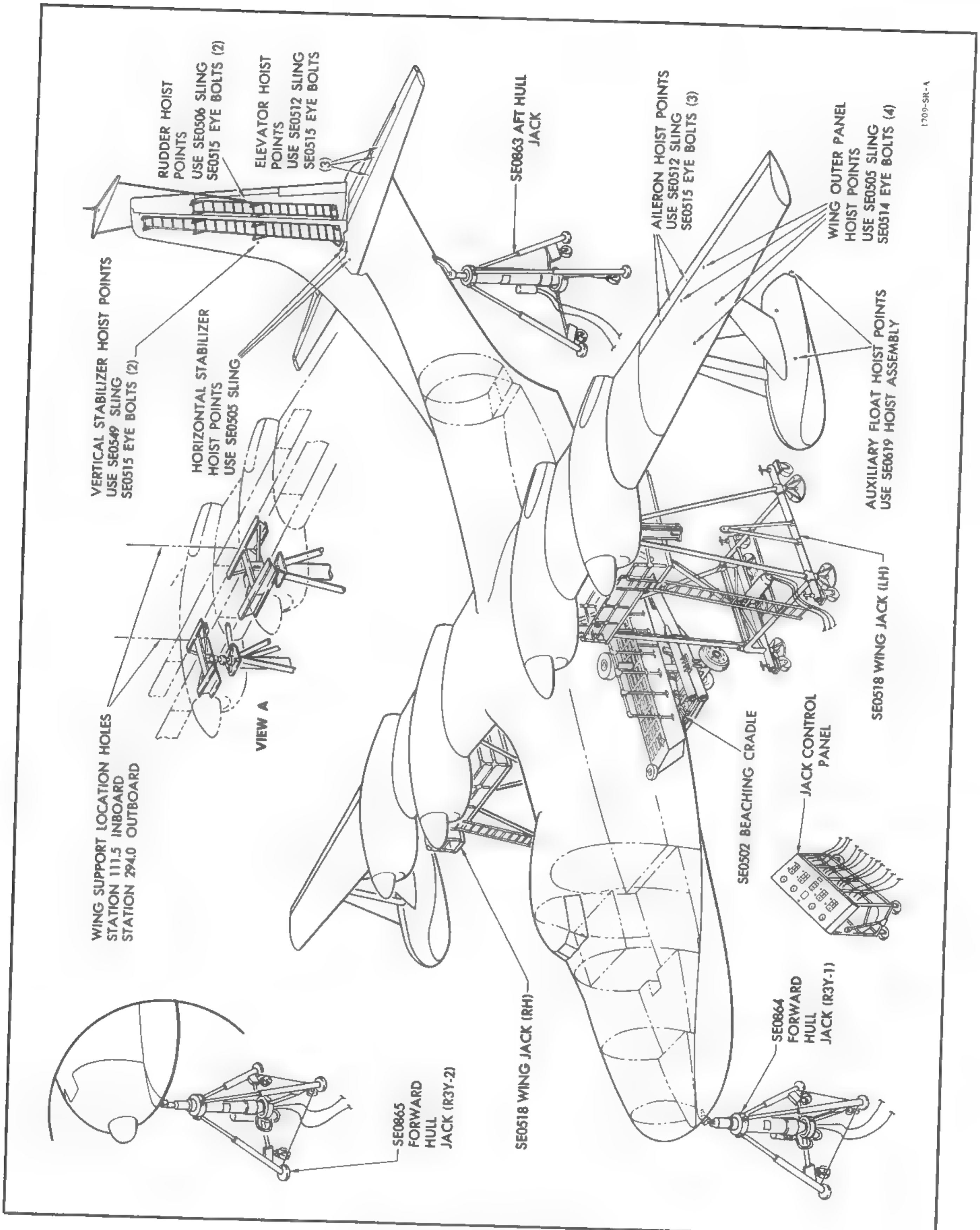


Figure 1-11. Jacking and Hoisting

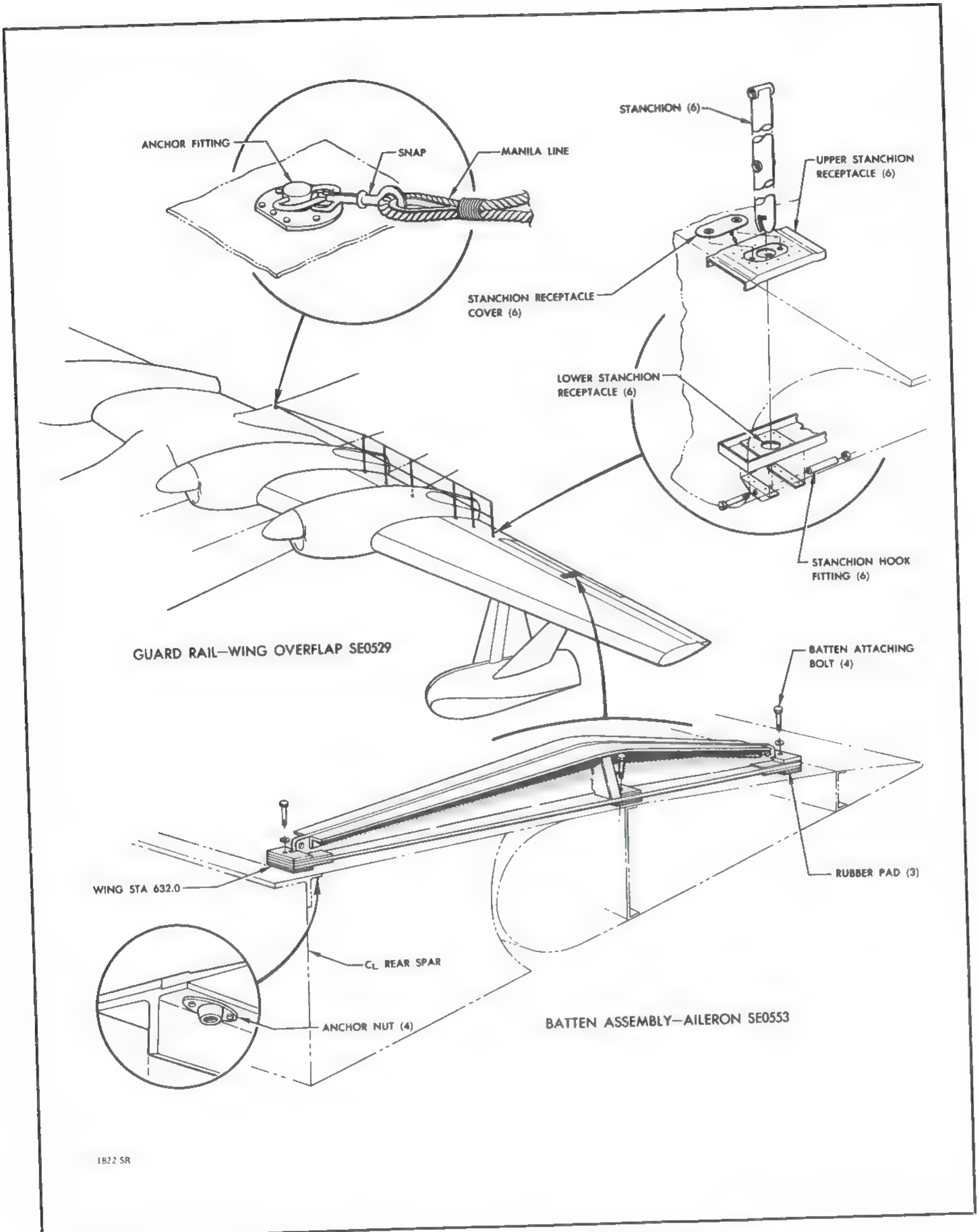


Figure 1-12. Wing Guard Rail and Aileron Batten

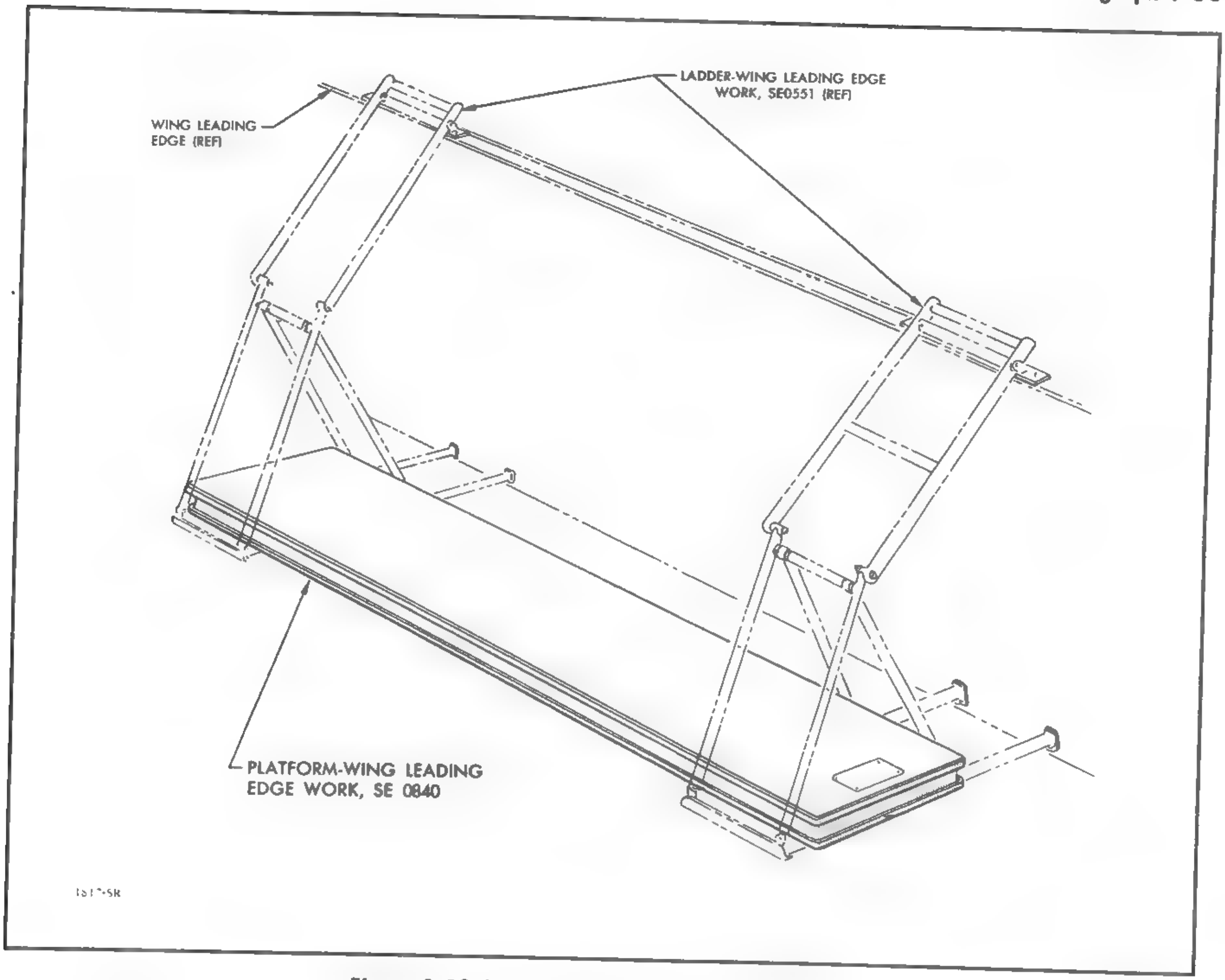


Figure 1-13. Wing Leading Edge Work Platform

1-38. NEGLIGIBLE DAMAGE. In a broad sense this classification shall consist of any damage or distortion which can be permitted to exist or can be corrected by a simple procedure and which will place no restriction on flight or water-handling operation. Placing a damage in this category will necessitate a working knowledge of the particular functions of the part which is damaged. Following are damages which may be classed as negligible, depending on dimension and location.

a. *Dents:* Small dents with no gouging, no damage to structure and which cause no interference with any operation, may be classed as negligible. The lighter the material in which they are located, the less important. Dents may be straightened or permitted to remain.

b. *Bends:* Bent structural members which can be returned fully to their original shape, with no kinks or cracks, need not be replaced. This usually occurs in conjunction with other more serious damage.

c. *Scratches* and *Nicks:* Scratches which do not exceed the depth of the alclad surface of sheet or formed members may always be classed as negligible. This may be determined by thoroughly cleaning the surface with Methyl Ethyl Keytone and applying a 10 percent (by weight) solution of Sodium Hydroxide (NaOH) to the scratch or nick. The clad surface will remain bright. If the scratch has penetrated to the aluminum alloy core it will be indicated by a black or blackish-brown discoloration. The solution need not remain longer than two minutes and should be thoroughly removed with water as it is very corrosive. If the clad is not penetrated, the scratch may be burnished to minimize it. Treat with chromic acid before priming and painting. Scratches or nicks on extruded or forged structural parts, which do not start at an edge or corner, which extend less than 25 percent across a flat face and are not deeper than 5 percent of the thickness of the part or 0.010 inch (whichever is smaller), may be classed as negligible. If deeper, or located at edges or corners, engineering approval will be required and sharp edges must be removed or the member repaired.

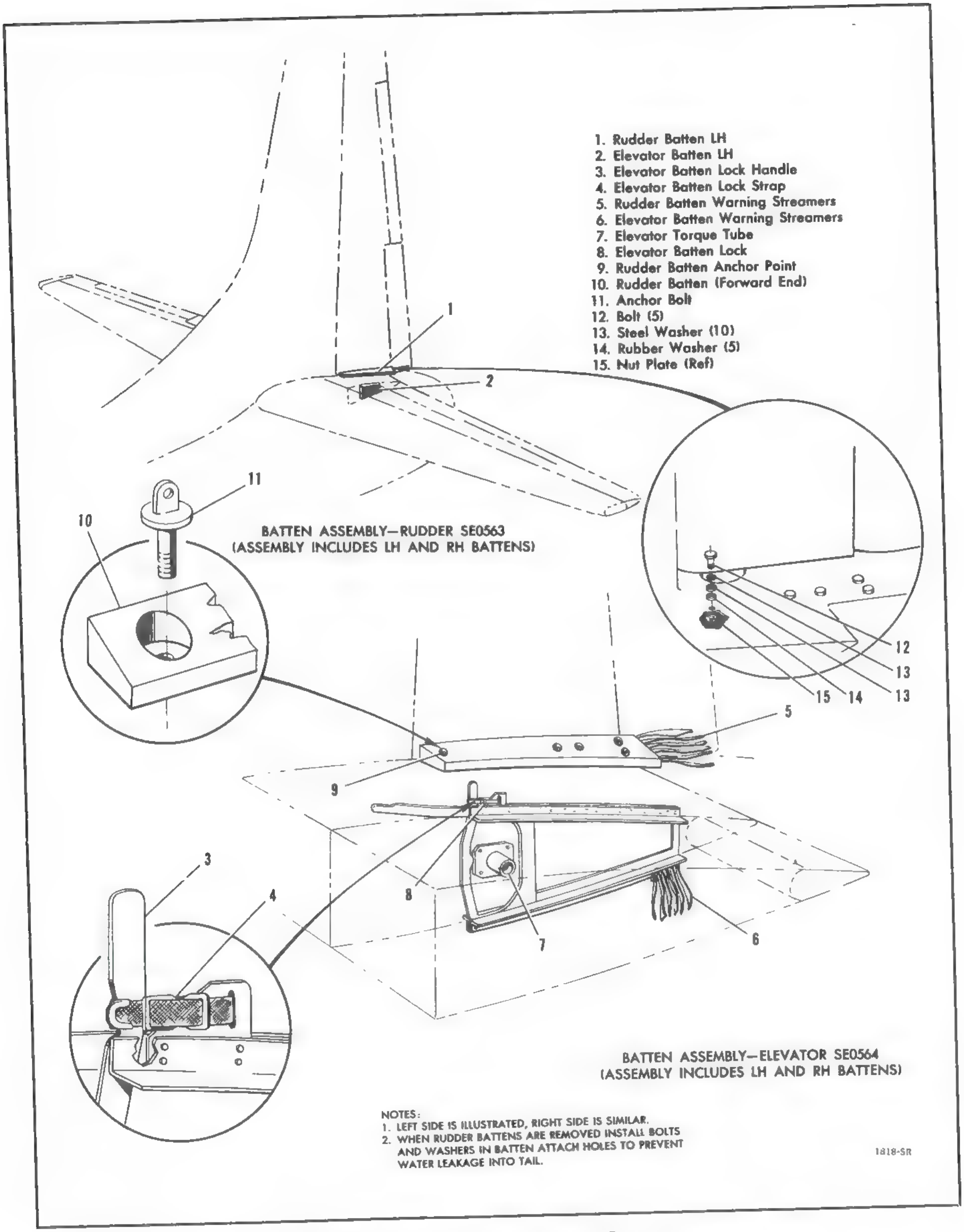


Figure 1-14. Rudder and Elevator Battens

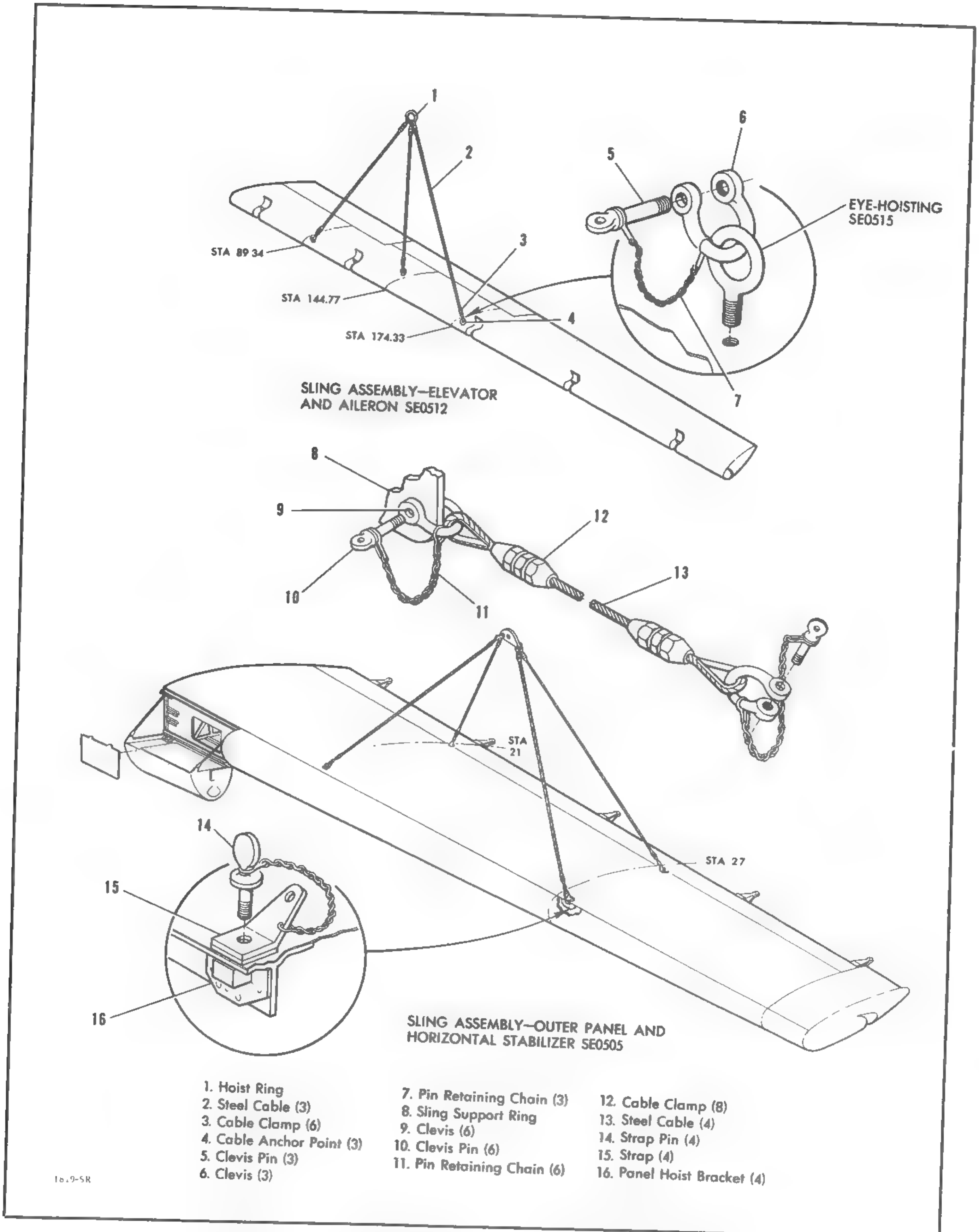
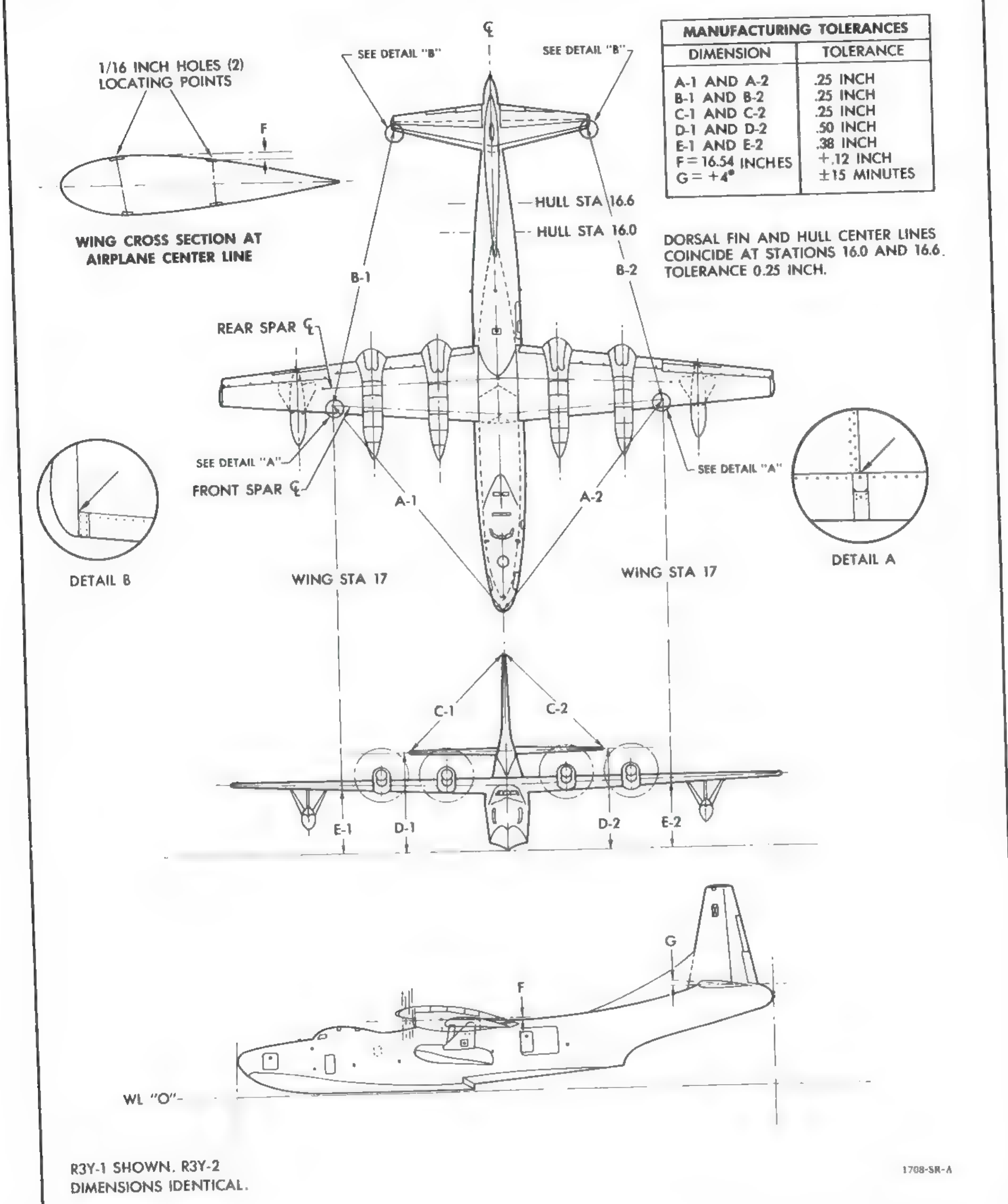


Figure 1-15. Outer Wing Panel and Horizontal Stabilizer Sling



MANUFACTURING TOLERANCES

DIMENSION	TOLERANCE
A-1 AND A-2	.25 INCH
B-1 AND B-2	.25 INCH
C-1 AND C-2	.25 INCH
D-1 AND D-2	.50 INCH
E-1 AND E-2	.38 INCH
F = 16.54 INCHES	+.12 INCH
G = +4°	±15 MINUTES

Figure 1-16. Rigging Diagram

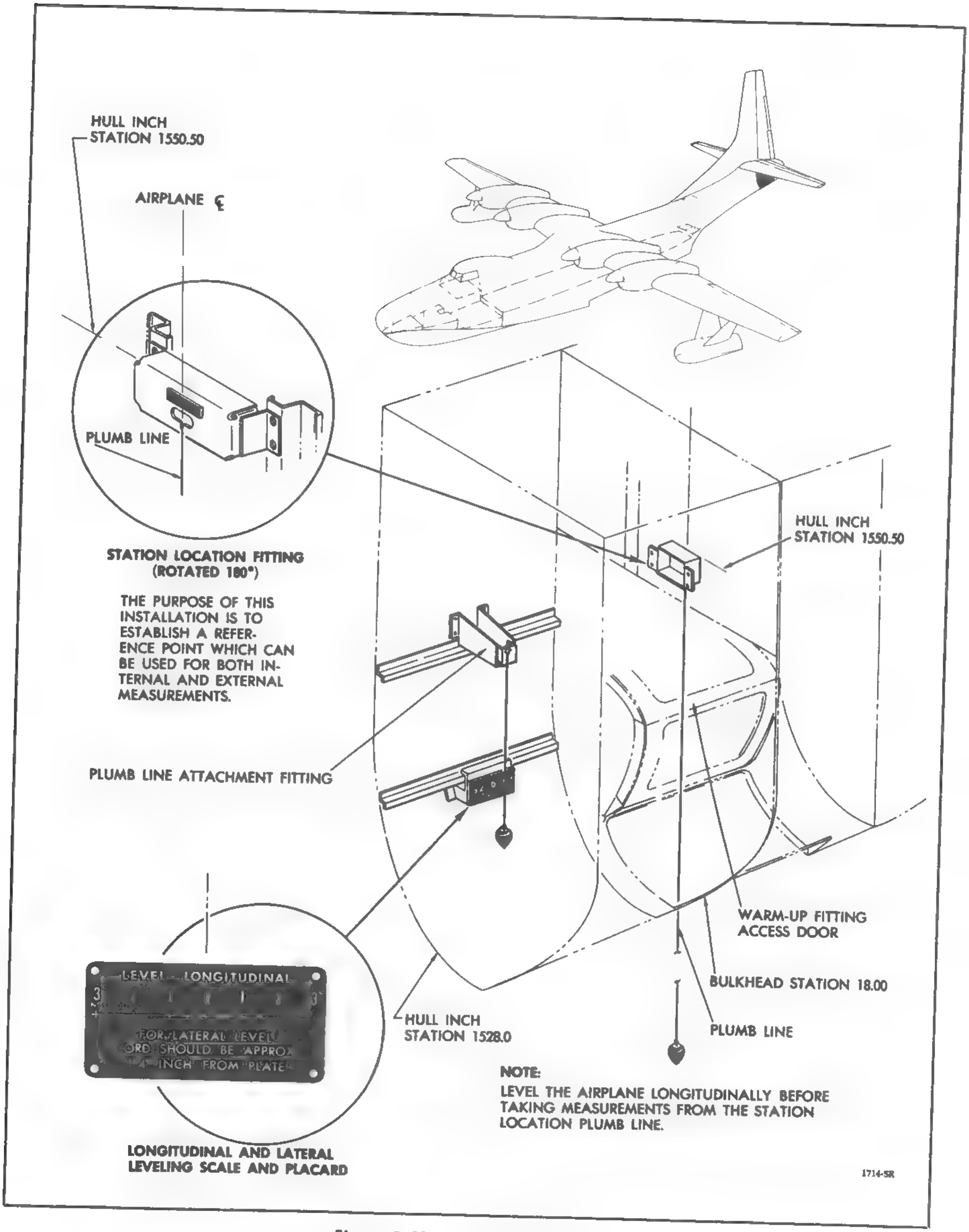


Figure 1-17. Leveling Provisions

d. *Cracks:* Cracks in 24ST aluminum alloy used in light skin of fairings and unstressed locations, where fuel, air, and watertightness are not involved, are considered negligible. Limit cracks to one inch—stop drill the ends and watch for further development. Cracks in 75ST aluminum alloy must be stop drilled and the entire length of the crack routed out to approximately one-eighth inch. All burrs and blemishes must be smoothed and edges rounded, then a typical plating repair made over the area as outlined in appendix II.

e. *Holes:* A hole which is less than 10 percent of the width of the part involved or one inch (whichever is smaller), and which is more than four times its diameter from any edge, radius, rivet pattern or other hole, may be classed as negligible if it does not interfere with the function of the part. Interferences might be failure in fuel, water, air, and weather tightness. Any sharp corners or cracks should be rounded or stop drilled.

f. *Corrosion:* Corrosion damage which does not exceed the limits established for scratches and nicks may be classed as negligible. The part must be cleaned and treated with chromic acid before priming and painting, to arrest the corrosive action.

1-39. DAMAGE REPAIRABLE BY PATCHING. Damage repairable by patching is any damage which is best repaired by superimposing reinforcements over the damaged area. Damages in this classification are holes and cracks in skin, spar and bulkhead webs, frames, stringers, and stiffeners. The reinforcements and fasteners must be so designed and located as to return the part to full structural strength and not interfere with its function. It should be as light as possible. Fillers may be used for bearing purposes and to carry out the original contour of the part.

1-40. DAMAGE REPAIRABLE BY INSERTION. When damages are more extensive, requiring the insertion of new sections of structural members or skin in a manner which will enable the inserted parts to carry structural loads, they are repaired by insertion. For example, if an angle were cracked completely across, it would be repaired by superimposing an angle of equal or greater cross section and attaching to each broken end with a suitable rivet pattern. If a short section of the above angle were removed, the splice angle superimposed would be longer and a filler of the same thickness as the original angle would be inserted between the broken ends to furnish bearing if skin were being attached. The same rivet pattern would be used in attaching the splice angle to the broken ends as in the first repair. Rivets used in the insert would be additional. Both of these repairs would be repairs by patching. If a longer section of angle were damaged, a new section would be inserted and attached at each end by a splice angle in the same manner as the first repair. This would be a repair by insertion as the insert will be carrying the structural loads of the original member. The same types of rivets and same formulas for developing the rivet count required would be used in each case. For this reason most of the typical repairs illustrated in this handbook are repairs by patching. In many cases only one half the repair is shown as the rivet pattern on each side of the break is the same.

1-41. DAMAGE NECESSITATING REPLACEMENT OF PARTS. This type of repair is generally the simplest, and most satisfactory, from an engineering viewpoint. When correctly accomplished, the strength, weight and appearance of the damaged area will be exactly the same as it was originally. The replacement might be an aileron spar stiffener, a section of aileron spar web, ribs and skin, or an entire aileron. Original rivet patterns and seams would be used and no special engineering would be required. The most obvious reason for the replacement of a part is a large percentage of damage (generally above 50 percent). Forged and cast fittings damaged beyond negligible limits cannot be repaired and must be replaced. Damaged components must be removed very carefully so as not to damage adjacent or attaching parts and should be retained until the repair is completed. They may be used for reference in fabrication or assembly of the new component and as repair materials.

1-42. MATERIALS USED IN FABRICATING REPAIR AND REPLACEMENT PARTS.

1-43. GENERAL. As aluminum alloys constitute the major part of this airplane's structure, only they will be dealt with at this point. The three factors of importance in the repair material used are alloy, shape, and condition. Duplication in all three respects is always desirable but substitution is permissible, subject to certain limitations.

1-44. ALLOY. The two alloys to be used as repair materials are 24S and 75S. 75S in the tempered or hardened condition is considerably stronger than 24ST. It may be used as a substitute for 24ST using the same cross-sectional area. 24ST may be used as a substitute for 75ST only by increasing the cross-sectional area. (See table 1-I.) The major part of the primary structure is 75ST and in case of doubt concerning the alloy of a part, assume it to be 75ST.

1-45. SHAPE. This factor is divided into three classifications; rolled sheet, extruded shapes, and drawn bar stock. Their uses are as follows:

a. *Rolled sheet* may be obtained in a variety of thicknesses and in clad or unclad condition. Only alclad sheet is used in this airplane. It is used in fabricating patches for skin, spar, and bulkhead webs and formed to produce splice and replacement members. Roll formed shapes also may be used for the same purpose. These are listed as "Y" sections in Section VIII of this handbook.

b. *Extruded shapes* are used very extensively in heavily stressed locations. Replacement parts should be of the same die number extrusion whenever possible. Roll formed shapes may not be used as a substitute for extruded shapes except with engineering approval. Other extrusions of equal or greater dimensions may be used or machined to the desired dimensions. Fittings may be machined from extruded shapes. (Refer to Section VIII for the list and description of extruded shapes used in this airplane.)

MATERIAL TO BE SUBSTITUTED	ULTIMATE TENSILE STRENGTH	24S-			75S-	
		T3	T4		T6	
		Clad	Clad	Extruded	Clad	Extruded
61S-T6 Extruded	38,000 psi	1.0	1.0	1.0	1.0	1.0
61S-T6 Clad	42,000 psi	1.0	1.0	1.0	1.0	1.0
24S-T4 Extruded	57,000 psi	1.0	1.0	1.0	1.0	1.0
14S-T6 Clad	57,000 psi	1.0	1.0	1.0	1.0	1.0
24S-T4 Clad	58,000 psi	1.0	1.0	1.02	1.0	1.0
14S-T6 Extruded	60,000 psi	1.0	1.04	1.05	1.0	1.0
24S-T3 Clad	60,000 psi	1.0	1.04	1.05	1.0	1.0
75S-T6 Clad	72,000 psi	1.20	1.26	1.28	1.0	1.0
75S-T6 Extruded	78,000 psi	1.30	1.35	1.37	1.09	1.0

a. Locate the horizontal row containing the symbol of the material being replaced.

b. Locate the vertical column containing the symbol of the substitute material.

c. To obtain the minimum thickness of the substitute material, multiply the thickness of the material to be replaced by the factor found at the intersection of the row and column found by steps A and B respectively.

NOTE

4130 (Chrome Molybdenum) steel may be substituted for 75ST splice members when the heavy gage of the aluminum alloy repair parts interfere with attachment or with other assemblies. This substitution is recommended only in case of necessity. 0.6 times the thickness of the material being replaced will be minimum thickness of the steel substitute. Heat treat to 160,000 to 180,000 psi after forming.

Table 1-I. Material Substitution Factors

c. *Draw bar stock* may be used as a shape from which parts may be machined. Fittings or substitutes for extruded shapes machined from bar stock are slightly weaker than the extruded or forged shapes of the same alloy. The cross-sectional area of stressed portions of the substitute part should be left approximately 5 percent greater than the original to compensate for this lower strength factor.

1-46. TEMPER. The aluminum alloys used in the airplane primary structure are heat treatable alloys and are in the "T" (hard) condition as found in the airplane. All repair and reinforcement materials used must also be in the hard condition when the repair is completed. (See table 1-I for values and substitution factors.) Stronger materials may be substituted for weaker ones but the same cross-sectional area must be used. Weaker materials may be substituted for stronger ones but the cross-sectional area must be increased.

a. 24S is a repair material listed. In sheet stock as purchased, it will be alclad and in the T3 condition. Parts fabricated from this stock without reheat-treatment will retain this rating. If reheat-treated and formed in the "W" or soft condition, they will carry a rating of 24S-T4. Both of these repair materials are stronger than 24S-T4 extrusions. Roll formed sections as listed in Section VIII are alclad and either 24S-T3 or 75S-T6. If a 24S-T3 roll formed member is reheat-treated to

facilitate further forming, it will be 24S-T4 after hardening. Extruded members of 24S will retain the rating of T4 if reheat-treated. Most of the forming operations of 24S materials, including dimpling, may be done while in the "T" condition.

b. 75S is more commonly used in the R3Y than 24S. As purchased in rolled sheet, roll formed shapes, extruded shapes or drawn bar stock, it carries the temper rating of T6. Due to the hardness of the material, it must be reheat-treated and formed while in the "W" (soft) condition. It retains the T6 rating after this operation. Extruded or drawn bar 75S-T6 is stronger than 75S-T6 alclad sheet or formed sections and this factor should be considered in designing substitute or reinforcement members. (See table 1-I.) Dimpling E5S-T6 sheet material by ordinary machine dimpling methods is not practical as the material is very likely to crack. (Refer to paragraph 1-53 and see figure 1-21.)

1-47. FASTENER INFORMATION.

1-48. GENERAL. Every repair which is made on the structure will involve fasteners. It is desirable to use the same fasteners as used in manufacture of the part; however, this is not always possible and the fastener used will depend on availability of fasteners, accessibility and facilities available. The fasteners used will differ in material, temper, head type and method of installation as well as diameter. (See table 1-II for fastener substitution information.) The information following is to aid in the selection of the fastener best suited to the individual repair.

56S (B) Rivet
Cherry Blind Rivet (Aluminum)
A17ST (AD) Rivet
17ST (D) Rivet
17STA (TA) Rivet
24STA (DD) Rivet
AN Bolt } Same Value
Hi-Shear Rivet } Same Value
Corrosion-Resistant Steel Rivet
Huck Lockbolt (Steel)
NAS Bolt
Any fastener listed may be used as a substitute for fasteners of the same diameter located *above* it in this chart.

Table 1-II. Fastener Substitution Chart

a. "B" Rivets: Material 56S. Not heat-treatable. Used only in non-stressed locations and in the fabrication of the magnesium floor used in the cargo compartment.

b. "AD" Rivets: A17S-T material. Driven in the hard condition. Used in small diameters and especially in flush application up to ⅛ inch diameters.

c. "D" Rivets: 17S-T material. Driven soft after heat-treatment. May be refrigerated. Not used very extensively in this airplane.

d. "TA" Rivets: 17S-TA material. This rivet is the same as the "D" rivet except that it is driven in the hard condition. It is stronger than the "D" rivet due to work hardening while being driven. This is the rivet most commonly used in this airplane.

e. "DD" Rivets: 24S-T material. Driven in the soft condition immediately after heat-treatment. May be refrigerated. This is the most commonly used aluminum rivet in the integral fuel tank area. Being soft when driven, its hole filling qualities are better than those of "TA" rivets.

f. Corrosion resistant steel rivets: These are solid shank rivets with a hollow end to facilitate forming of the shop head. They are quite extensively used in highly stressed parts of the primary structure where gages of material are heavy. They are driven using ordinary riveting equipment.

g. Huck lockbolts: Material is heat-treated steel, cadmium plated. Used extensively for connecting heavy gage structural members in the wing. Their strong clamping action is a big advantage. (See figures 1-18 and 1-19 for installation and removal details.)

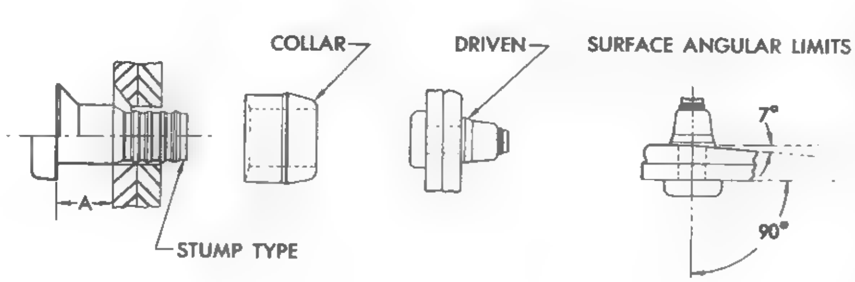
h. Hi-Shear Rivets: Material is heat-treated steel, cadmium plated. These fasteners are not used in the manufacture of this airplane but serve the same purpose as Huck lockbolts, though not quite as strong. (See tables 1-III and 1-IV for drilling and countersinking data and figure 1-20 for installation details.)

i. AN Bolts: AN bolts may be used as substitutes for permanent type fasteners. Hole sizes should be the same as for Hi-Shear rivets.

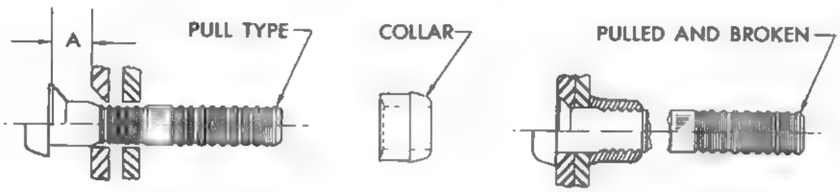
j. NAS Bolts: These are internal wrenching, heat-treated, high tensil strength steel bolts. They should be used with special high strength nuts only. They are used only where highly stressed in tension. Never replace an internal wrenching bolt with an AN bolt.

RIVET SHANK DIA.	Convair Modified Hi-Shear Rivets Q4317 and Q4318	Alternate Installation NAS177 or NAS178 Rivets
	HOLE SIZE, + NOTED, − 0.000	HOLE SIZE, + NOTED, − 0.000
$3/16$	0.1850 + 0.0030	0.1890 + 0.0020
$1/4$	0.2450 + 0.0030	0.2490 + 0.0020
$5/16$	0.3065 + 0.0040	0.3115 + 0.0020
$3/8$	0.3690 + 0.0040	0.3740 + 0.0020

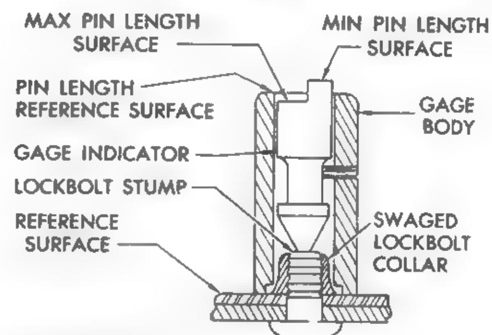
Table 1-III. Hole Size for Hi-Shear Rivets or AN Bolts



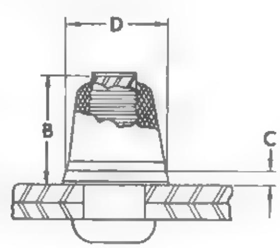
GRIP — NUMBER	GRIP RANGE MIN	GRIP RANGE MAX	"A"
1	.031	.094	.062
2	.094	.156	.125
3	.156	.219	.187
4	.219	.281	.250
5	.281	.344	.312
6	.344	.406	.375
7	.406	.469	.437
8	.469	.531	.500
9	.531	.594	.562
10	.594	.656	.625
11	.656	.718	.687
12	.718	.781	.750
13	.781	.843	.812
14	.843	.906	.875
15	.906	.968	.937
16	.968	1.031	1.000
17	1.031	.094	1.062

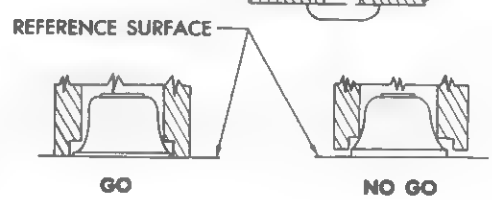


STUMP AND COLLAR GAGE

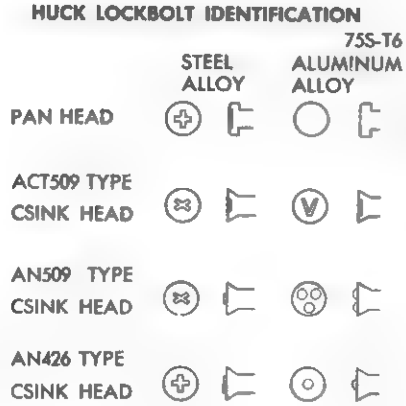


DIAMETER LOCKBOLT	PART NUMBER	B	C	D	GAGE NUMBER
3/16	ALS - T6	.212 / .298	.059	.298	AT - 539 - A
1/4	ALS - T8	.283 / .375	.069	.395	AT - 539 - B
5/16	ALS - T10	.373 / .455	.080	.500	AT - 539 - C
3/8	ALS - T12	.483 / .545	.157	.590	AT - 539 - D





HUCK LOCKBOLT IDENTIFICATION



STANDARD COLLAR IDENTIFICATION

"C" — 24S — T4 ALUMINUM ALLOY — DYED GREEN. USE WITH STEEL LOCKBOLTS ONLY.

"F" — 61S — T6 ALUMINUM ALLOY — PLAIN (ANODIZED). USE WITH ALUMINUM ALLOY LOCKBOLTS ONLY.

"R" — MILD STEEL — CADMIUM PLATED. USE WITH STEEL LOCKBOLTS FOR HIGH TEMPERATURE APPLICATION

RECOMMENDED DRILLING PROCEDURE

SIZE	HOLE FILLING APPLICATION			NON HOLE FILLING APPLICATION	
	PRE - DRILL	SIZE DRILL	HOLE TOLERANCE	SIZE DRILL	HOLE TOLERANCE
3/16	No. 18 .1695	No. 13 .185	.185 - .187	No. 11 .191	.191 - .203
1/4	1 .228	C .242	.242 - .246	1/4 .250	.250 - .265
5/16	L .290	7.75MM .3051	.305 - .309	5/16 .3125	.3125 - .330
3/8	11/32 .343	U .368	.368 - .371	3/8 .375	.375 - .395

1712-SR

Figure 1-18. Huck Lockbolt Installation

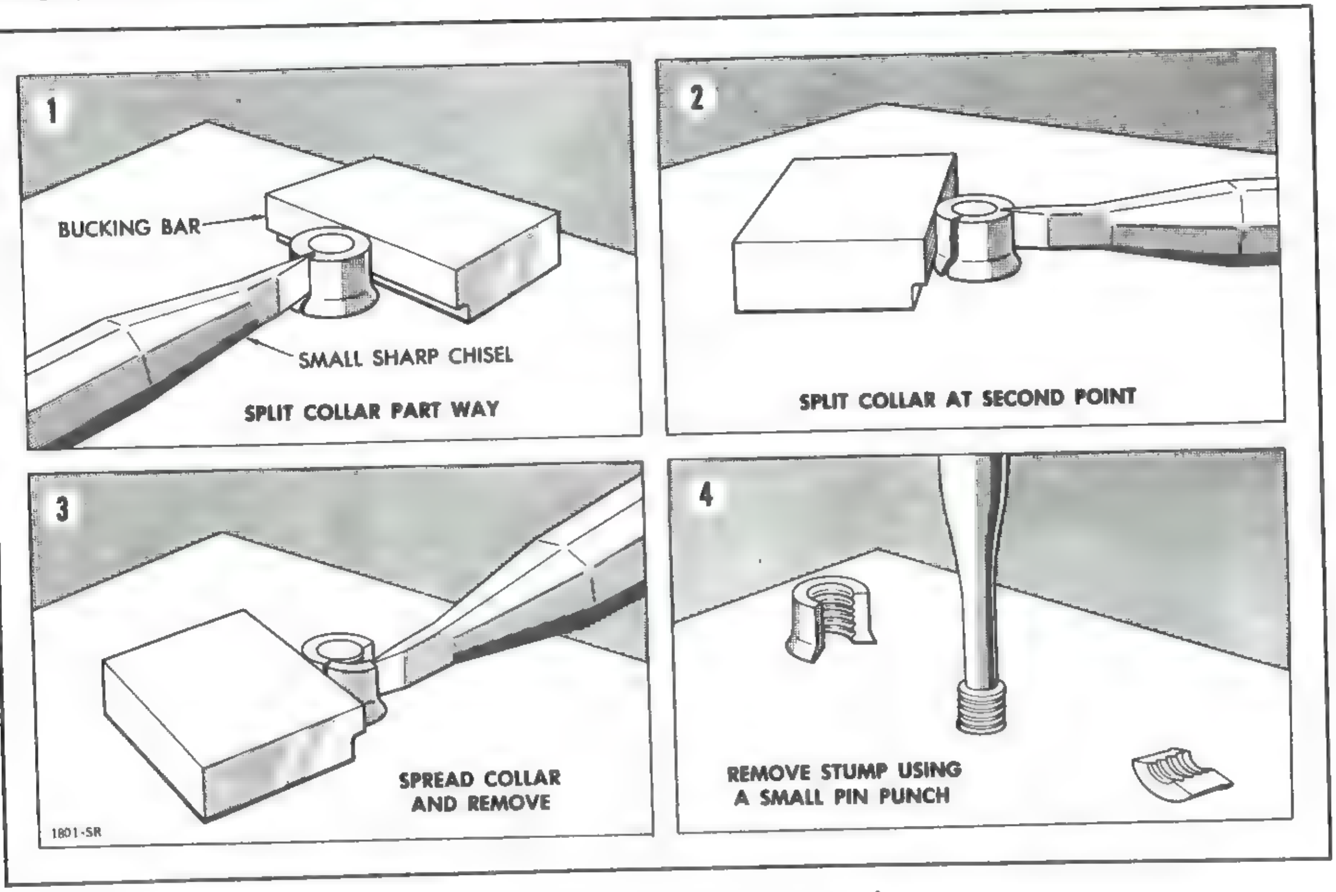


Figure 1-19. Huck Lockbolt Removal

1-49. FASTENER HEAD TYPE. Protruding head fasteners are used for nearly all internal structural purposes. They are also used externally in application of skin to the hull and auxiliary float structure. Repairs should be designed to employ them except when the heads would interfere with some special function. One hundred degree countersunk head fasteners are used throughout in application of external skin to the wing and control surfaces. Repairs of these skins should be designed to follow this practice whenever possible. Light gage materials must be dimpled and heavy gage materials machine countersunk. When a patch of heavy gage is installed to pick up a machine countersunk rivet hole, the void in the original sheet must be filled by inserting a taper bushing. This bushing is made by drilling the head of a 100 degree countersunk head rivet with a drill of the diameter used in installation of the rivet. Insert the remaining collar or bushing in the countersunk hole of the original sheet prior to superimposing the patch. (See figure 1-21.)

Rivet Diameter				
Pilot Hole Diameter	0.1250	0.1562	0.1562	0.1562
Nominal Countersink Diameter	0.298	0.391	0.475	0.568
Head Spotface Diameter	0.3750	0.5000	0.6250	0.7500
Collar Spotface Diameter	0.5625	0.6250	0.7500	0.8750

Table 1-IV. Countersunk Dimensions for Hi-Shear Rivets

1-50. BLIND RIVETS. The use of blind rivets has been minimized as much as possible in manufacture. They may be used for repairs in nonstressed locations or in areas where used in manufacture. In all other instances their use will require engineering approval. When required, the standard AF462B, 100 degree countersunk head and AF463B, brazier head rivets are recommended. (Information concerning these rivets is included in tables, 1-V, 1-VI, 1-VII, and 1-VIII.)

1-51. RIVET SHANK DIAMETER. It is good practice to use the same diameter rivets in a repair as were used by the manufacturer. In designing a skin repair, use the size rivets found in the seams at the edge of the damaged sheet. For an extruded structural member splice, use the rivet diameter used in attaching the ends of the member. When no satisfactory precedent has been established, use a rivet diameter approximately

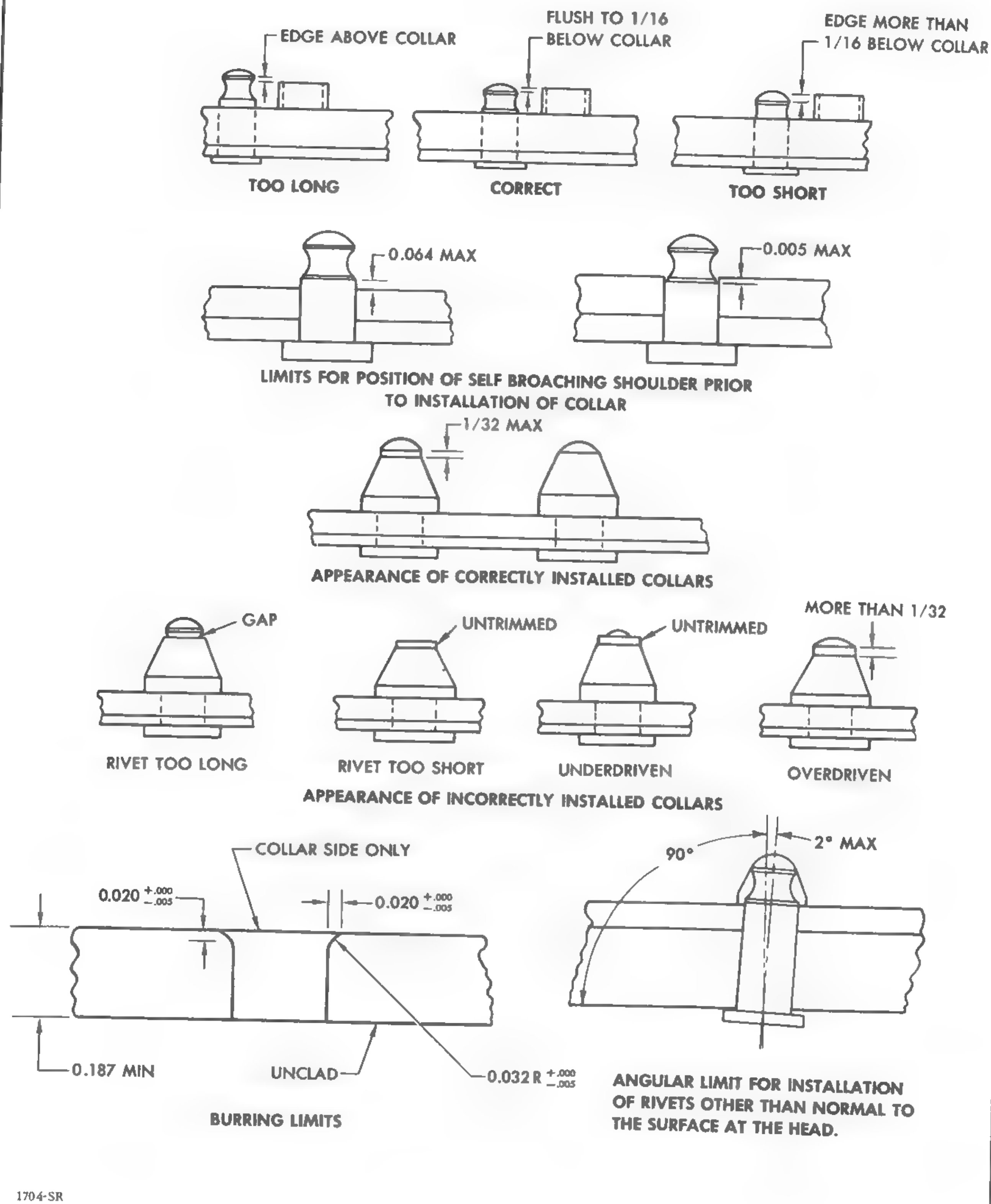
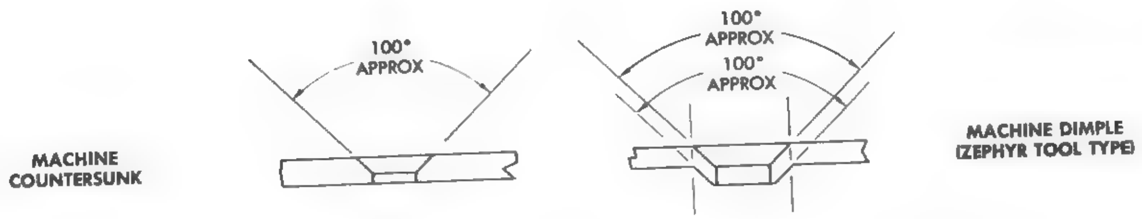


Figure 1-20. Hi-Shear Rivet Installation



NOTE 1 THE FIGURES ABOVE INDICATE THE TYPICAL ANGULAR DIMENSIONS OF TOOLS USED TO INSTALL COUNTERSUNK RIVETS AS REQUIRED BY THIS STANDARD. ALL DIMPLED AND COUNTERSUNK RIVET INSTALLATION DATA ARE BASED ON THE AN426 TYPE (100°) RIVET AND THE TOOLS USED SHALL BE DESIGNED ACCORDINGLY. IN ADDITION DESIGN AND USE OF THE TOOLS SHALL BE SUCH AS TO ACCOMPLISH THE REQUIREMENTS GIVEN BELOW, SUCH AS FLUSHNESS, NESTING, ETC.

2 PROVIDED THE INDICATED LIMITATIONS ARE OBSERVED, CHOICE BETWEEN THE VARIOUS METHODS OF INSTALLING COUNTERSUNK RIVETS IS OPTIONAL WITH THE SHOP.

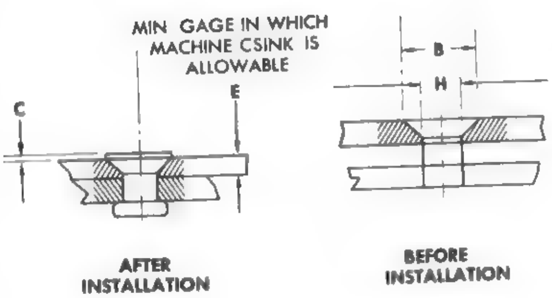
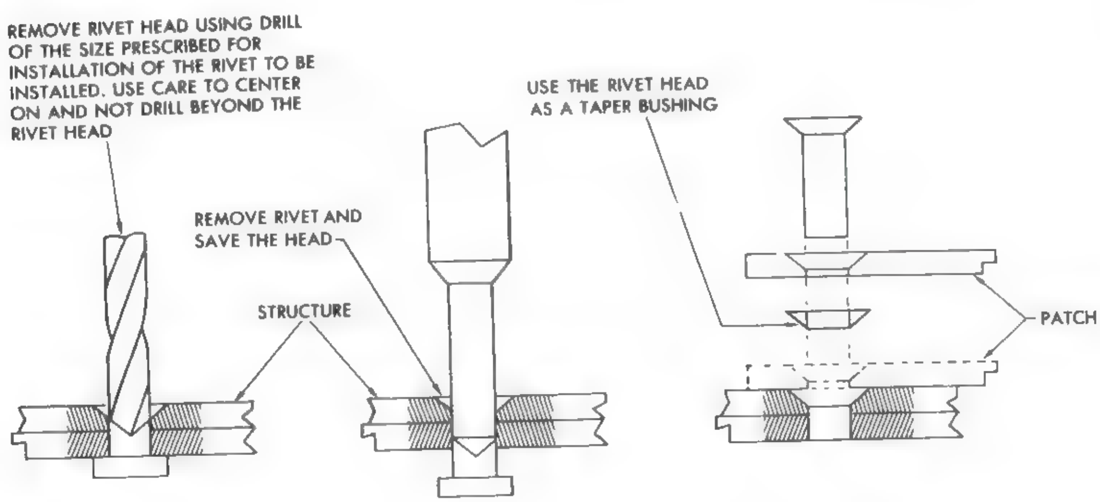


TABLE I

NOMINAL RIVET DIA		1/16	3/32	1/8	5/32	3/16	1/4	5/16	3/8
B (NOMINAL)		.114	.179	.225	.287	.355	.478	.569	.697
C	MAX	.008	.008	.008	.008	.008	.008	.008	.008
E		.032	.040	.051	.064	.064	.064	.064	.064
H	MIN	.067	.099	.128	.161	.191	.257	.323	.386
	MAX	.073	.105	.134	.167	.199	.265	.331	.394

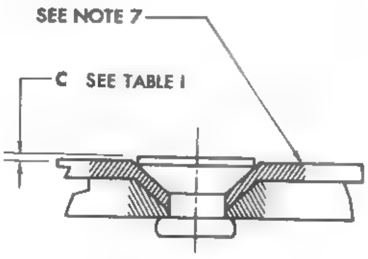
NOTE 3 WHEN INSTALLING A HEAVY GAGE PATCH WHICH PICKS UP A MACHINE COUNTERSUNK HOLE IN THE ORIGINAL MEMBER, USE METHOD SHOWN BELOW.



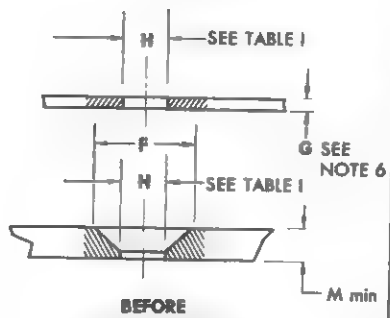
1718-1SR

Figure 1-21. Flush Rivet Installation (Sheet 1 of 3)

DIMPLED SKIN



AFTER INSTALLATION



BEFORE INSTALLATION

TABLE II

G (NOMINAL)	NOMINAL RIVET DIAMETER 3/32	1/8	5/32	3/16	1/4
	F (NOMINAL) SEE NOTE 5				
.020	.194	.240	.302	.370	.493
.025	.198	.244	.306	.374	.497
.032	.202	.248	.310	.378	.501
.040		.254	.316	.384	.507
.051			.325	.393	.516
.064				.403	.526
.072					.537
.081					.549
M min	.051	.064	.081	.102	.125

NOTE 5 VALUES IN TABLE II ARE FOR USE ONLY WHEN THE TOP SHEET IS DIMPLED WITH THE RIVET HEAD. WHEN TOP SHEET IS MACHINE DIMPLED, USE TABLE III.

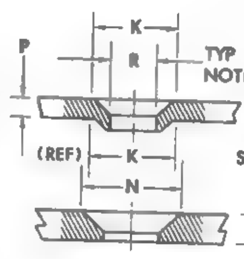
6 TABULATED VALUES FOR DIMENSION "G" ALSO APPLY AS A TOTAL VALUE WHEN MORE THAN ONE SHEET IS DIMPLED SIMULTANEOUSLY INTO A MACHINE COUNTERSINK WITH THE RIVET HEAD.

7 USE OF THIS INSTALLATION METHOD IS RESTRICTED TO APPLICATIONS WHERE THE TOP SHEET HAS FORMING CHARACTERISTICS EQUAL TO OR BETTER THAN 24ST.

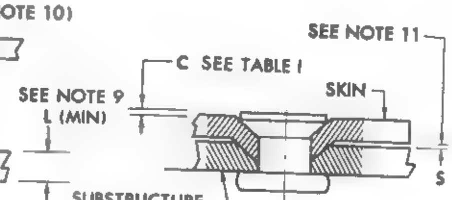
MACHINE DIMPLED SKIN

TABLE III

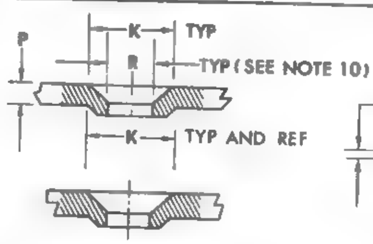
NOMINAL RIVET DIAMETER		3/32	1/8	5/32	3/16	1/4
N	NOMINAL DIA OF MACHINE CSINK	.189	.235	.297	.365	.488
K	NOMINAL DIA OF MACHINE DIMPLE	.179	.225	.287	.355	.478
L	(MIN)	.040	.051	.064	.072	.091
P	(MAX)	.032	.040	.051	.051	.051
R		.107 .099	.140 .128	.175 .161	.216 .191	.280 .257



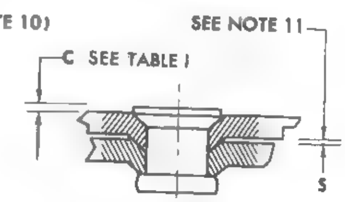
BEFORE INSTALLATION



AFTER INSTALLATION



BEFORE INSTALLATION



AFTER INSTALLATION

NOTE 8 VALUES IN TABLE III ARE FOR USE IN THE FOLLOWING APPLICATIONS:
(A) WHEN MACHINE DIMPLED SHEET (OR SHEETS) IS RIVETED TO MACHINE COUNTERSUNK SHEET (OR SHEETS SEE NOTE 6)
(B) WHEN INDIVIDUALLY MACHINE DIMPLED SHEETS ARE RIVETED TOGETHER. (DIMENSION "K" IS APPLICABLE EVEN THOUGH MORE THAN TWO MACHINE DIMPLED SHEETS ARE JOINED.)

9 THE MACHINE COUNTERSUNK SHEET INDICATED BY DIM. "L" MAY CONSIST OF MORE THAN ONE SHEET PROVIDED THE TOTAL THICKNESS IS NOT LESS THAN "L."

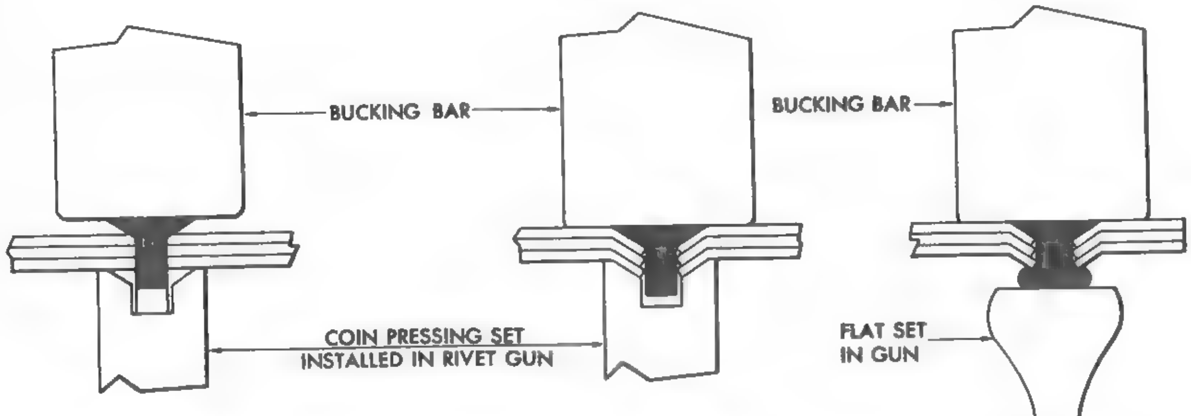
10 WHEN REQUIRED BY TOOLING LIMITATIONS, VALUES FOR DIMENSION "R" IN MACHINE DIMPLES MAY BE MET AFTER DIMPLES ARE FORMED.

11 TO PROPERLY TRANSMIT SHEAR, DIMPLES SHOULD NEST TIGHTLY IN COUNTERSINKS. THIS MAY RESULT IN GAPS BETWEEN SHEETS WHICH WILL BE ACCEPTABLE SUBJECT TO THE FOLLOWING CONDITIONS:
A. THE GAP(S) SHALL NOT EXCEED 0.004" ADJACENT TO 3/32 RIVETS, 0.006" ADJACENT TO 1/8" RIVETS, 0.008" ADJACENT TO 5/32", 3/16" OR 1/4" RIVETS.
B. THE AREAS AFFECTED ARE NOT INTENDED TO BE LIQUID TIGHT.
C. THE GAPS DO NOT CAUSE RIPPLES THAT ARE OBJECTIONABLE FROM AN APPEARANCE STANDPOINT.

1718-2SR

Figure 1-21. Flush Rivet Installation (Sheet 2 of 3)

COIN DIMPLING



BEFORE DIMPLING AFTER DIMPLING RIVET HEADED

TABLE IV

THICKNESS OF COMBINED SHEETS (MAX)	MATERIAL NOTED	PROCESS COIN DIMPLE	
	RIVET DIAMETER		
	1/8	5/32	3/16
.070			
.080			75ST
.090			
.100			
.110			
.120	24ST		
.130			
.140			

NOTE 12 TABLE IV IS APPLICABLE ONLY WHEN MORE THAN ONE SHEET IS DIMPLED SIMULTANEOUSLY BY THE COIN DIMPLING PROCESS. WHEN THE SUM OF THE COMPONENT SHEETS FALLS ABOVE THE HEAVY LINE OF THE MATERIAL INDICATED, THE SHEETS MAY BE DIMPLED SIMULTANEOUSLY PROVIDED THE APPLICABLE LIMITS ARE OBSERVED.

NOTE 13 COIN DIMPLING IS A PROCESS WHERE THE RIVET IS USED AS A TOOL FOR DIMPLING TWO OR MORE SHEETS SIMULTANEOUSLY. THE SHEETS ARE BACKED UP BY A RECESSED TOOL DURING THE DIMPLING OPERATION. THEN A FLAT TOOL FORMS THE SHOP HEAD. THIS METHOD HAS THE ADVANTAGE OF MAKING IT POSSIBLE TO INSTALL 100° COUNTERSUNK RIVETS IN DIMPLED SKIN APPLICATION WHEN DEALING WITH 75ST WITHOUT HOT DIMPLING EQUIPMENT. IT IS SUBJECT TO THE FOLLOWING LIMITATIONS:

A. IT SHALL BE USED ONLY WHEN NECESSARY AS THE RIVET HEAD DEFORMS SO THAT THE REPLACEMENT WITH A STANDARD 100° RIVET IS NOT FEASIBLE.
B. IT SHALL NOT BE USED WHERE THE RIVET MATERIAL IS SOFTER THAN A17S.
C. THE GAGE OF ANY SINGLE SHEET OR A COMBINATION OF SHEETS SHALL NOT EXCEED 1/2 OF THE MAXIMUM VALUE ALLOWABLE FOR THE COMBINATION AS DETERMINED FROM TABLE IV.

14 TABLE IV IS SUBJECT TO THE FOLLOWING LIMITATIONS:

A. WHERE 24ST IS INDICATED, THE FOLLOWING MATERIALS ARE TO BE INCLUDED: 24SO, 24ST, 75SO AND 75SW (WITHIN 2 HOURS AFTER QUENCH).
B. WHERE 75ST IS INDICATED, THE FOLLOWING MATERIALS ARE TO BE INCLUDED: 14ST, 75SW, 75ST, 24RT ("Y" SECTIONS), 24S-RT, 24S-T80, 24S-T81, 24S-T84 AND 24S-T86.
C. WHERE MORE THAN ONE MATERIAL IS USED SO THAT BOTH 75ST AND 24ST LIMITATIONS ARE APPLICABLE, THE 75ST LIMITATIONS SHALL BE USED.

15 A 3X GUN SHOULD BE USED FOR 1/8, 5/32 AND 3/16 INCH RIVETS WHEN THE COMBINED MATERIAL THICKNESS IS 0.080 INCH OR LESS. A 4X GUN SHOULD BE USED WHERE THE COMBINED THICKNESS IS BETWEEN 0.064 AND 0.150 INCH. WHERE THICKNESS LIMITATIONS OVERLAP, EITHER SIZE GUN MAY BE USED.

1718-3SR

Figure 1-21. Flush Rivet Installation (Sheet 3 of 3)

three times the thickness of the material being repaired but never more than 25 percent of the width of the flange in which it is installed.

1-52. RIVET LENGTH. The length of a rivet must be sufficient to provide material to produce a satisfactory shop head. The shop head should be approximately 0.5 times shank diameter in height and 1.5 times shank diameter in width. To produce this, the rivet should protrude approximately 1.5 times shank diameter when inserted, and before driving. The rivet nomagraph, figure 1-22, may be used to determine the rivet length when the thickness of the seam (grip) and rivet diameter are known. (For the length of Hi-Shear rivets and Huck lockbolts, see figures 1-18 and 1-20.)

1-53. HOT DIMPLING.

1-54. GENERAL. This method consists of locally elevating the temperature of the metal before dimpling to minimize the possibility of cracks developing during the operation. 75ST is the only aluminum alloy used in the construction of this airplane which requires this method. Holes should be smooth with burrs removed before dimpling. Drilling undersize and reaming aids in obtaining this condition.

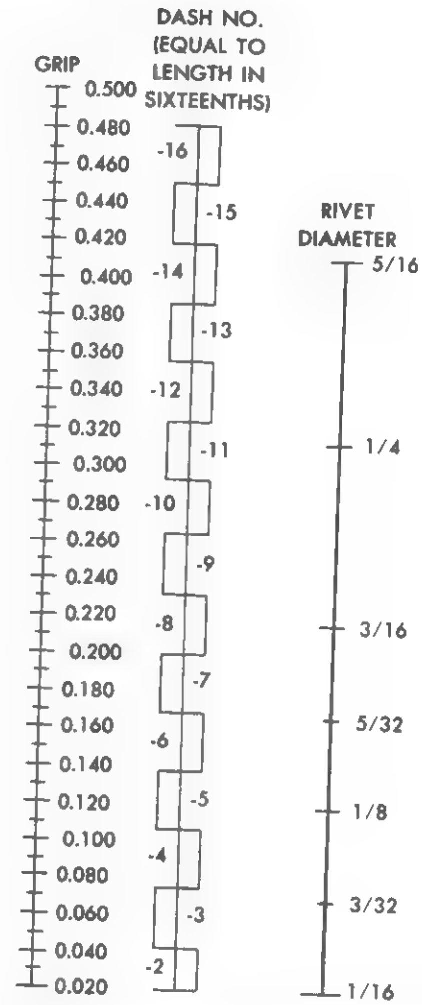
1-55. DIMPLING TEMPERATURE. The temperature of the metal is elevated to 162.7° to 176.7°C (325° to 350°F) locally by conduction of heat from a heated die. This temperature is determined by the use of Tempilaq applied to the metal adjacent to the hole to be dimpled. Tempilaq is a special lacquer with the characteristic of suddenly melting at a predetermined temperature. Make sure the Tempilaq is rated to melt at 162.7°C (325°F). The temperature of the die should never exceed 332.2°C (650°F) and the dwell time required to melt the Tempilaq should never exceed 30 seconds. Dimpling should be done at the first indication of melting of the Tempilaq. Sample dimples, using a scrap of the same gage 75ST, should always be executed to insure the die is correctly heated and operating satisfactorily.

1-56. EQUIPMENT. The equipment may be either heavy units automatically timed to an operating dwell time controlled by the operator, or by simple portable equipment using a 332.2°C (650°F) soldering iron and depending entirely on the use of Tempilaq to determine correct temperature. With the former, Tempilaq should be applied at intervals as a check of the accuracy of settings, while with portable equipment it should be applied at each dimple.

NOTE

Temperature control is very important in this operation. Temperatures too low may result in cracked dimples while temperatures too high will destroy the hardness of the sheet.

RIVET NOMOGRAPH



Instructions: Place a straight edge on the Nomograph from the point on the rivet diameter scale indicating the diameter of the rivet to be used, to the point on the grip scale indicating the required grip. The dash number for the correct rivet length will be found at the intersection of the straight edge and the dash number scale. In cases where the straight edge intersects the point between the two dash numbers, use the higher of the two numbers.

1700-SR

Figure 1-22. Rivet Length Required When Grip is Known

1-57. DESIGN PRINCIPLES OF STRUCTURAL REPAIRS.

1-58. GENERAL. The skin throughout the airplane is stressed to varying degrees, and is indicated by its thickness, or gage, which varies with the loads to be imposed upon it. Any damage to skin must be repaired so it can carry out its particular functions. In all cases the contour must be maintained as nearly as possible for aerodynamic reasons. This is especially true of wing,

tail and control surfaces. External patches and protruding head rivets should not be used there. Where water, gas, or air tightness are required, application of sealants to faying surfaces and design of rivet patterns must be such as to provide these qualities. Also, the repair must return the ability of the plating to carry its design structural load of approximately 75 percent of its full strength.

1-59. FACTORS AFFECTING STRENGTH OF A REPAIR. There are three factors affecting the strength of a repair: strength of the patch or reinforcement, strength of the fasteners used, and design of the fastener pattern. They will be dealt with in the above order.

1-60. PATCH OR REINFORCEMENT. The material of the patch or reinforcement should be the same as the original. If substitution is required, see table 1-I. Patches for skin or spar web should be the same gage or next gage heavier. Splice members for structural parts should have at least equal, but usually greater, cross-sectional area than the original depending on design. (See figures 1-24, 1-25 and 1-26.)

1-61. STRENGTH OF FASTENERS: The strength of the fasteners is dependent on their material, diameter, count, and to a certain extent, on head style. (See rivet count required tables, 1-V to 1-X, to determine the number of fasteners needed to return a repaired part to full design strength.) By applying the appropriate table for a known material and gage of a part to be repaired and the known head type, material and shank diameter of fastener, the number of fasteners required for one inch of seam is obtained. This factor times the length of seam will give the total count required.

1-62. FASTENER PATTERN. This factor is quite important in designing a repair. Terms used in describing rivet patterns and the reason for the importance of these factors are:

a. *Row:* A row is a line of rivets parallel to a seam or splice.

b. *Edge Distance:* The distance between the centerline of a rivet hole and the edge of the sheet, patch or structural member—it must be sufficient to prevent tearout.

c. *Pitch:* The distance between centerlines of rivet holes in a row. A row of rivet holes with 4 times rivet shank diameter pitch will remove 25 percent of the material and reduce strength to 75 percent, which is the design strength factor used in these repairs.

d. *Row Spacing:* The distance between rows when more than one row of rivets are installed in a seam—it must be sufficient to minimize probability of cracking between holes.

e. *Stagger:* The eccentric location of rivets in adjacent rows. (Increases distance between rivets and prevents buckling of light gage skin.)

1-63. MINIMUM SPACING RIVET PATTERNS. The values stated in figure 1-23 are minimum. Minimum patterns are desirable for appearance, weight saving and sealing qualities. More open patterns are desirable for structural reasons. A compromise with values somewhat greater than minimum is usually most satisfactory. The number of rows of rivets in the pattern will be dictated by the rivet count per inch. A minimum value of four-times-diameter has been established. This reduces the strength of the plate to 75 percent along the line of rivets. If a patch of the next heavier gage material is used, the pitch of the inner row of rivets may be less than four times the rivet shank diameter, but never less than three diameters. This method may be used to provide room for the required number of rivets without going to a three row pattern. When three or more rows of rivets are used, the pitch of the center row or rows may also be less than four rivet shank diameters but not less than three diameters. Each method has the advantage of accommodating a larger count of rivets without a sacrifice of structural strength of the original plate. When more than one row of rivets are used the rivets should be staggered. Throughout the hull, each seam must consist of two or more rows with rivets staggered, and a maximum pitch of four diameters (plus 10 percent), to meet requirements of water and air tightness.

1-64. RECTANGULAR REPAIR. (See figure 1-24.) When designing a rectangular repair, the length of each side of the damage, in inches, times the rivet count per inch, will give the number of rivets which must be installed along that side. The size of patch required must be sufficient to provide room for the number of rivets required while observing minimum edge distance, pitch, and row spacing requirements.

NOTE

The rivet pattern developed through this area shall be carried out at the corners.

The rivets used in filling out the corners are in addition to the rivets required by the original computation.

1-65. ROUND REPAIR. (See figure 1-25.) A satisfactory rivet pattern for a round patch may be determined as follows: Find the rivet count per inch. Taking the diameter of the hole in inches, times four, times rivet count required per inch, will result in the rivet count required for the entire repair.

1-66. FLUSH TYPE REPAIR. The preceding description has dealt with external or surface patches; however, the same rules hold for internal or flush patches. If the riveting is to be flush, with countersunk or dimpled skin, the appropriate rivet spacing and rivet count illustrations shall be used. A filler plate of the same gage as the original is fitted to the prepared hole and attached to the patch or back-up plate. The purpose of this filler is to carry out the contour of the plate and has no structural function. A single row of rivets of relatively open spacing around the edges is generally satisfactory. In larger patches and thin plate it is often desirable to install some rivets in the central portion of

24ST ALCLAD SHEET OR 24ST ALUMINUM ALLOY EXTRUSIONS RIVET COUNT REQUIRED PER INCH OF SEAM

TYPE	AN426 AND AN470 RIVETS															BLIND RIVETS		
MATERIAL	AD					TA					D		DD			ALUMINUM		
DIAMETER	3	4	5	6	8	4	5	6	8	10	8	10	8	10	12	4	5	6
Skin Gage 0.020	4.5					2.1	1.4	1.0								6.2		
0.025	5.6	3.3				2.6	1.7	1.1								7.1	4.5	
0.032		4.0	2.8			3.3	2.2	1.5	0.8		1.0					7.9	5.1	3.5
0.040		5.0	3.3	2.4		4.1	2.7	1.9	1.1		1.1		1.0			9.2	6.0	4.3
0.051		6.4	4.2	2.9	1.7	5.2	3.4	2.4	1.3	0.8	1.5	0.9	1.2				6.8	5.1
0.064			5.2	3.6	2.0		4.7	3.2	1.8	1.2	2.0	1.2	1.6	1.1			7.3	5.8
0.072			5.9	4.1	2.3		5.1	3.6	2.0	1.3	2.2	1.4	1.9	1.2	0.8			6.3
0.081				4.6	2.6			4.0	2.3	1.4	3.1	2.0	2.1	1.3	0.9			6.8
0.091				5.2	2.9			4.5	2.5	1.6	2.5	1.6	2.3	1.5	1.1			
0.102				5.7	3.2			4.8	2.8	1.8	2.8	1.8	2.6	1.6	1.2			
0.125				7.0	4.0			5.0	3.5	2.2	3.9	2.4	3.2	2.0	1.5			
0.156								7.3	4.1	2.7	4.8	3.1	4.0	2.5	1.8			
0.188								9.7	5.1	3.3	5.6	3.6	4.6	3.1	2.3			
0.210									5.7	3.7	6.3	4.0	5.2	3.4	2.5			
0.250									7.0	4.4	7.6	4.8	6.2	4.0	2.8			

NOTES:

1. This table is computed using a design factor of 80% of 24S-T3 Alclad ultimate tensile strength.
2. Blind rivet section is applicable to Cherry blind rivets CR156 and CR157. Other Cherry blind rivets, DuPont Explosive or Huck blind rivets, may be substituted, using these values.

Table 1-V. Rivet Count Required in 24ST Using Protruding Head Rivets (or 100° Countersunk Head Rivets in Dimpled Skin)

75ST ALCLAD SHEET OR 75ST ALUMINUM ALLOY EXTRUSIONS RIVET COUNT REQUIRED PER INCH OF SEAM

TYPE	AN426 AND AN470 RIVETS															BLIND RIVETS		
MATERIAL	AD					TA					D		DD			ALUMINUM		
DIAMETER	3	4	5	6	8	4	5	6	8	10	8	10	8	10	12	4	5	6
Skin Gage 0.020	5.7					2.7	1.8	1.2										
0.025	7.0	4.0	2.9			3.3	2.2	1.4			0.9					8.3	5.4	
0.032		5.0	3.3			4.4	2.9	1.9	1.1		1.4		1.0			9.7	6.3	4.2
0.040		6.3	4.1	2.8		5.2	3.6	2.4	1.4		1.5	0.9	1.2			11.0	7.1	5.1
0.051		8.0	5.2	3.6	2.0	6.7	4.4	3.2	1.7		1.9	1.1	1.6	1.0		12.3	8.1	6.1
0.064			6.5	4.4	2.5		5.4	3.8	2.0		2.3	1.6	1.9	1.3	0.9		8.9	7.0
0.072			7.3	5.1	2.8		6.2	4.3	2.4		2.7	1.7	2.3	1.5	1.0			7.5
0.081				5.7	3.2			4.8	2.7	1.7	2.9	1.9	2.5	1.6	1.1			8.1
0.091				6.4	3.6			5.3	3.0	2.0	3.2	2.1	2.8	1.8	1.2			
0.102				7.1	4.0			6.4	3.3	2.4	3.7	2.3	3.2	2.0	1.3			
0.125					4.9			7.4	4.1	2.6	4.5	2.8	3.8	2.4	1.7			
0.156								8.6	4.9	3.2	5.6	3.6	4.8	2.9	2.1			
0.188								10.7	6.0	4.0	6.5	4.3	4.9	3.7	2.5			
0.210									6.6	4.8	7.5	4.7	6.5	4.1	2.7			
0.250									8.2	5.2	9.0	5.6	7.5	4.8	3.4			

NOTES:

1. This table is computed using a design factor of 80% of 75S-T6 aluminum alloy extrusion ultimate tensile strength.
2. Blind rivet section is applicable to Cherry blind rivets CR156 and CR157. Other Cherry blind rivets, DuPont Explosive or Huck blind rivets, may be substituted, using these values.

Table 1-VI. Rivet Count Required in 75ST Using Protruding Head Rivets (or 100° Countersunk Head Rivets in Dimpled Skin)

24ST ALCLAD SHEET OR 24ST ALUMINUM ALLOY EXTRUSIONS
RIVET COUNT REQUIRED PER INCH OF SEAM

TYPE	AN426 RIVETS														BLIND RIVETS		
MATERIAL	AD					TA			D	DD				ALUMINUM		
DIAMETER	3	4	5	6	8	5	6	8	8	6	8	10	12	4	5	6
Skin Gage 0.040	10.0	6.2	4.6	3.9		4.1								9.3		
0.051		7.3	5.2	4.5		4.3	3.4			2.6				9.9	7.3	
0.064		8.8	6.6	4.9		4.9	3.7			3.5	2.5			10.3	9.0	7.5
0.072			6.7	5.3	2.7	5.2	3.9	2.7	2.8	3.8	2.5				9.3	8.2
0.081				5.7	2.8	5.6	4.2	2.7	2.9	4.1	2.6	2.2			9.3	9.2
0.091				6.2	3.0	6.1	4.5	3.0	3.1	4.6	2.8	2.4	2.2			
0.102				6.3	3.1		4.8	3.1	3.2	4.8	3.0	2.6	2.3			
0.125					3.2		5.0	3.2	3.3		3.0	2.8	2.7			
0.156							7.3	4.0			3.9	3.1	2.7			
0.188							9.7	5.0				4.9	4.0			
0.210								6.0					4.7			
0.250								7.0					5.3			

NOTES:

1. This table is computed using a design factor of 80% of 24S-T3 Alclad ultimate tensile strength.
2. Blind rivet section is applicable to Cherry blind rivets CH156. Other Cherry blind rivets, DuPont explosive or Huck blind rivets, may be substituted, using these values.

Table 1-VII. Rivet Count Required in Machine Countersunk 24ST

75ST ALCLAD SHEET AND 75ST ALUMINUM ALLOY EXTRUSIONS
RIVET COUNT REQUIRED PER INCH OF SEAM

TYPE	AN426 RIVETS													BLIND RIVETS		
MATERIAL	AD					TA			D	DD				ALUMINUM		
DIAMETER	3	4	5	6	8	5	6	8	8	6	8	10	12	4	5	6
Skin Gage 0.040	13.1	8.3	6.1			5.4								11.3		
0.051		9.6	6.8	5.2		5.6	4.5			4.3				12.2	9.3	
0.064		11.6	7.5	5.6		6.0	4.6			4.5	3.1			12.9	11.3	9.2
0.072		12.8	8.6	6.3	3.5	6.7	5.1	3.5	3.6	4.9	3.3				11.4	10.0
0.081			9.1	7.3	3.5	7.2	5.4	3.6	3.7	5.2	3.4	2.9	2.8		11.5	11.1
0.091				8.0	3.7	7.7	5.7	3.8	3.8	5.5	3.5	3.1	2.9			
0.102				9.3	4.0		6.2	4.0	4.1	6.1	3.8	3.2	2.9			
0.125					4.5		7.3	4.5	4.6	7.0	4.3	3.5	3.3			
0.156								5.1			4.8	3.7	3.6			
0.188								5.9				6.3	5.2			
0.210													5.9			
0.250													6.6			

NOTES:

1. This table is computed using a design factor of 80% of 75S-T6 Aluminum alloy extrusion ultimate tensile strength.
2. Blind rivet section is applicable to Cherry blind rivets CR156. Other Cherry blind rivets, DuPont explosive and Huck blind rivets, may be substituted, using these values.

Table 1-VIII. Rivet Count Required in Machine Countersunk 75ST

75ST ALCLAD SHEET OR 75ST ALUMINUM ALLOY EXTRUSIONS
FASTENER COUNT REQUIRED PER INCH OF SEAM

NAME	CORROSION RESISTANT STEEL				HUCK LOCKBOLTS, STEEL				HI-SHEAR RIVETS. "AN" BOLTS			
DIAMETER	5	6	8	10	6	8	10	12	6	8	10	12
Skin Gage 0.040	2.9	2.4	1.8	1.4	2.5	1.9	1.5	1.3	2.5	1.9	1.5	1.3
0.051	2.9	2.4	1.8	1.4	2.5	1.9	1.5	1.3	2.5	1.9	1.5	1.3
0.064	2.9	2.4	1.8	1.4	2.5	1.9	1.5	1.3	2.5	1.9	1.5	1.3
0.072	2.9	2.4	1.8	1.4	2.5	1.9	1.5	1.3	2.5	1.9	1.5	1.3
0.081	2.9	2.4	1.8	1.4	2.5	1.9	1.5	1.3	2.5	1.9	1.5	1.3
0.091	2.9	2.4	1.8	1.4	2.5	1.9	1.5	1.3	2.5	1.9	1.5	1.3
0.102		3.0	1.8	1.4	2.5	1.9	1.5	1.3	3.1	1.9	1.5	1.3
0.125		3.7	2.0	1.4	3.0	1.9	1.5	1.3	3.8	2.2	1.5	1.3
0.156		4.6	2.6	1.4	3.8	2.1	1.5	1.3	4.8	2.7	1.7	1.3
0.188			3.1	1.4		2.6	1.5	1.3		3.2	2.1	1.5
0.210			3.4	1.5		2.9	1.8	1.3		3.6	2.3	1.6
0.250			4.1	1.8		3.4	2.2	1.5		4.3	2.8	1.9

NOTE: This table is computed using a design factor of 80% of 75S-T6 Aluminum alloy extrusion ultimate tensile strength.

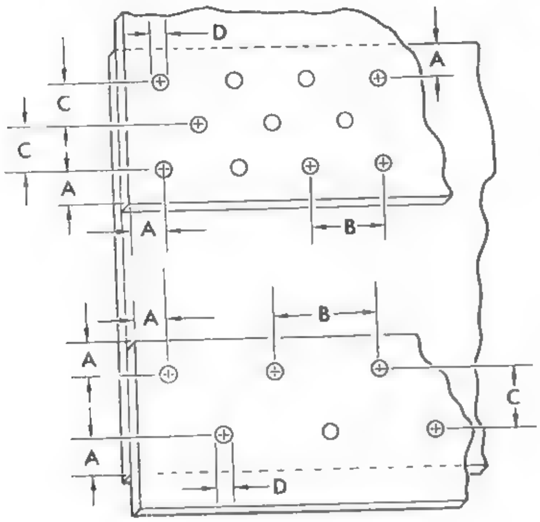
Table 1-IX. Protruding Head, High Strength Fastener Count Required in 75ST

75ST ALCLAD SHEET OR 75ST ALUMINUM ALLOY EXTRUSIONS
FASTENER COUNT REQUIRED PER INCH OF SEAM

NAME	CORROSION RESISTANT STEEL			HUCK LOCKBOLTS, STEEL		HI-SHEAR RIVETS. "AN" BOLTS	
DIAMETER	5	6	8	6	8	6	8
Skin Gage 0.040							
0.051	5.4	4.6		4.6		4.6	
0.064	5.4	4.6		4.6		4.6	
0.072	5.1	4.3		4.4		4.4	
0.081	4.9	4.2		4.3		4.3	
0.091	5.1	4.4		4.5		4.5	
0.102	5.3	4.8	4.5	4.9		4.9	
0.125	6.1	4.6	3.8	4.7	3.7	4.7	3.7
0.156	6.9	4.7	3.6	4.8	3.9	4.8	3.9
0.188	8.4	5.4	3.8	5.5	3.9	5.5	3.9
0.210			3.8		3.4		3.4
0.250			4.5		3.4		3.4

NOTE: This table is computed using a design factor of 80% of 75S-T6 Aluminum alloy extrusion ultimate tensile strength.

Table 1-X. High Strength Fastener Count Required in Machine Countersunk 75ST

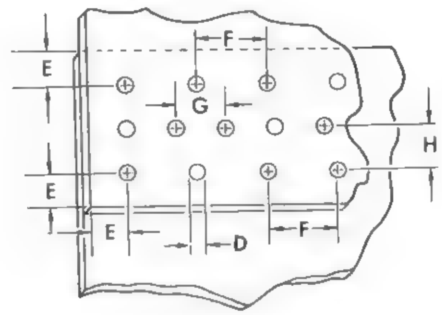


PROTRUDING HEAD OR DIMPLED SKIN

A = EDGE DISTANCE = 2D MINIMUM
B = PITCH OR SPACING = 4D MINIMUM
C = ROW SPACING = 2.5D MINIMUM
D = RIVET DIAMETER

COUNTERSUNK SKIN

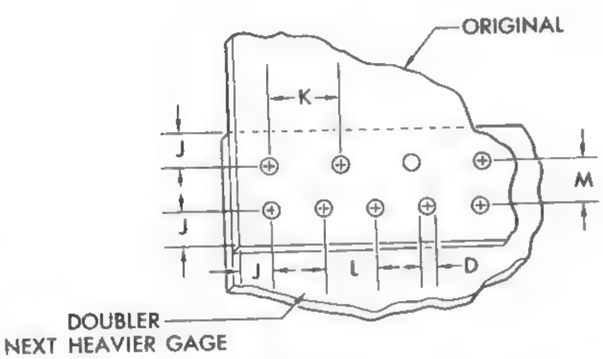
A = EDGE DISTANCE = 2D MINIMUM
B = PITCH OR SPACING = 6D MINIMUM
C = ROW SPACING = 3.5D MINIMUM
D = RIVET DIAMETER



PROTRUDING HEAD OR DIMPLED SKIN REPAIR

PATCH OR DOUBLER SAME GAGE AS ORIGINAL. WHEN 3 OR MORE ROWS OF RIVETS ARE USED THE PITCH OF THE CENTER ROW MAY BE 3D IF THE ROW SPACING IS 3.5D

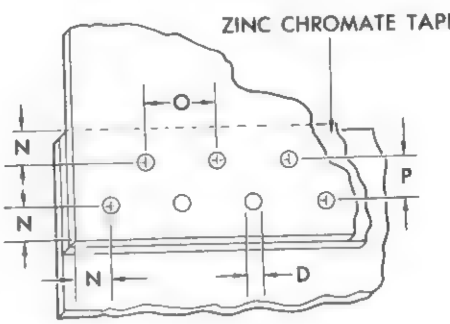
D = RIVET DIAMETER
E = EDGE DISTANCE 2D MINIMUM
F = PITCH (OUTSIDE ROWS) 4D MINIMUM
G = PITCH (CENTER ROWS) 3D MINIMUM
H = ROW SPACING 3.5D MINIMUM



PROTRUDING HEAD OR DIMPLED SKIN REPAIR

PATCH OR DOUBLER ONE GAGE HEAVIER THAN ORIGINAL. WHEN 2 OR MORE ROWS OF RIVETS ARE USED THE PITCH OF THE INNER ROW MAY BE 3D.

D = RIVET DIAMETER
J = EDGE DISTANCE = 2D MINIMUM
K = PITCH (OUTER ROW) = 4D MINIMUM
L = PITCH (INNER ROW) = 3D MINIMUM
M = ROW SPACING = 2.5D MINIMUM



PRESSURIZED HULL SKIN REPAIR USING PROTRUDING HEAD RIVETS

REPAIR TO BE STANDARD EXCEPT AS NOTED:
D = RIVET DIAMETER
N = EDGE DISTANCE = 2D MINIMUM
O = PITCH = 4D MIN (+10% MAX)
P = ROW SPACING = 2.5D MINIMUM
PATTERN MUST CONSIST OF AT LEAST 2 ROWS WITH RIVETS STAGGERED.
ZINC CHROMATE TAPE MUST BE APPLIED BETWEEN ALL FAYING SURFACES.

NOTE: THESE MINIMUM VALUES ARE APPLICABLE TO ALL RIVETED REPAIRS UNLESS OTHERWISE NOTED. WIDER SPACING IS GENERALLY DESIRABLE.

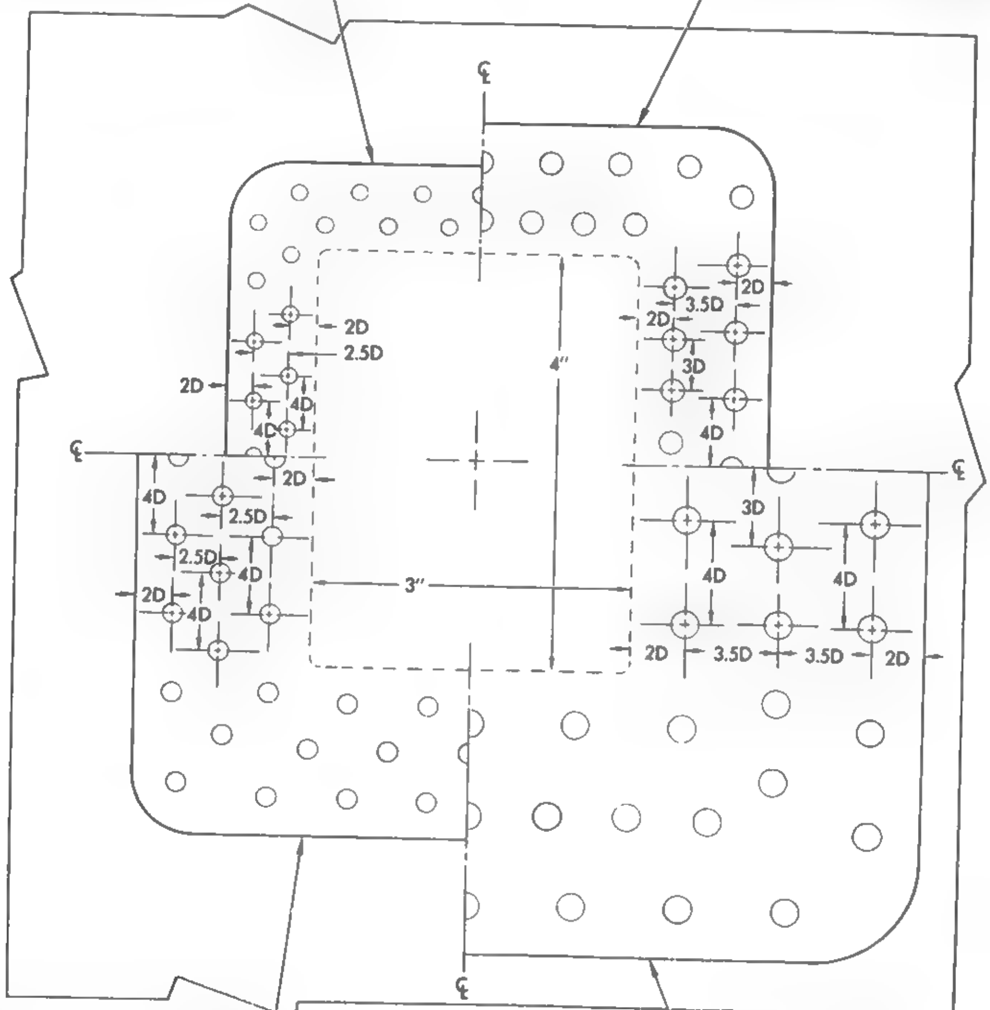
1702-SR

Figure 1-23. Minimum Spacing Rivet Patterns

FORMULA RIVET COUNT PER INCH X DIMENSION OF DAMAGE EDGE = RIVET COUNT PER EDGE. CONTINUE PATTERN AROUND CORNER. RIVETS LOCATED IN CORNER ARE ADDITIONAL.

ORIGINAL PLATING 0.025 (24ST)
REPAIR PLATE 0.025 (24ST)
USING AN470 AD4 RIVETS
3.3 RIVETS PER INCH
3 IN. × 3.3 = 9.9 USE 10 RIVETS
4 IN. × 3.3 = 13.2 USE 14 RIVETS

ORIGINAL PLATING 0.040 (75ST)
REPAIR PLATE 0.051 (75ST)
USING AN470TA5 RIVETS
3.6 RIVETS PER INCH
3 IN. × 3.6 = 10.8 USE 11 RIVETS
4 IN. × 3.6 = 14.4 USE 15 RIVETS



ORIGINAL PLATING 0.064 (75ST)
REPAIR PLATE 0.064 (75ST)
USING AN470TA6 RIVETS
3.8 RIVETS PER INCH
3 IN. × 3.8 = 11.4 USE 12 RIVETS
4 IN. × 3.8 = 14.4 USE 15 RIVETS

ORIGINAL PLATING 0.091 (75ST)
REPAIR PLATE 0.091 (75ST)
USING AN470DD8 RIVETS
3.2 RIVETS PER INCH
3 IN. × 3.2 = 9.6 USE 10 RIVETS
4 IN. × 3.2 = 12.8 USE 13 RIVETS

NOTES: 1. OBTAIN RIVET COUNT PER INCH FROM TABLE V OR VI
2. D = RIVET DIAMETER

1716-SR

Figure 1-24. Rectangular Plating Repairs

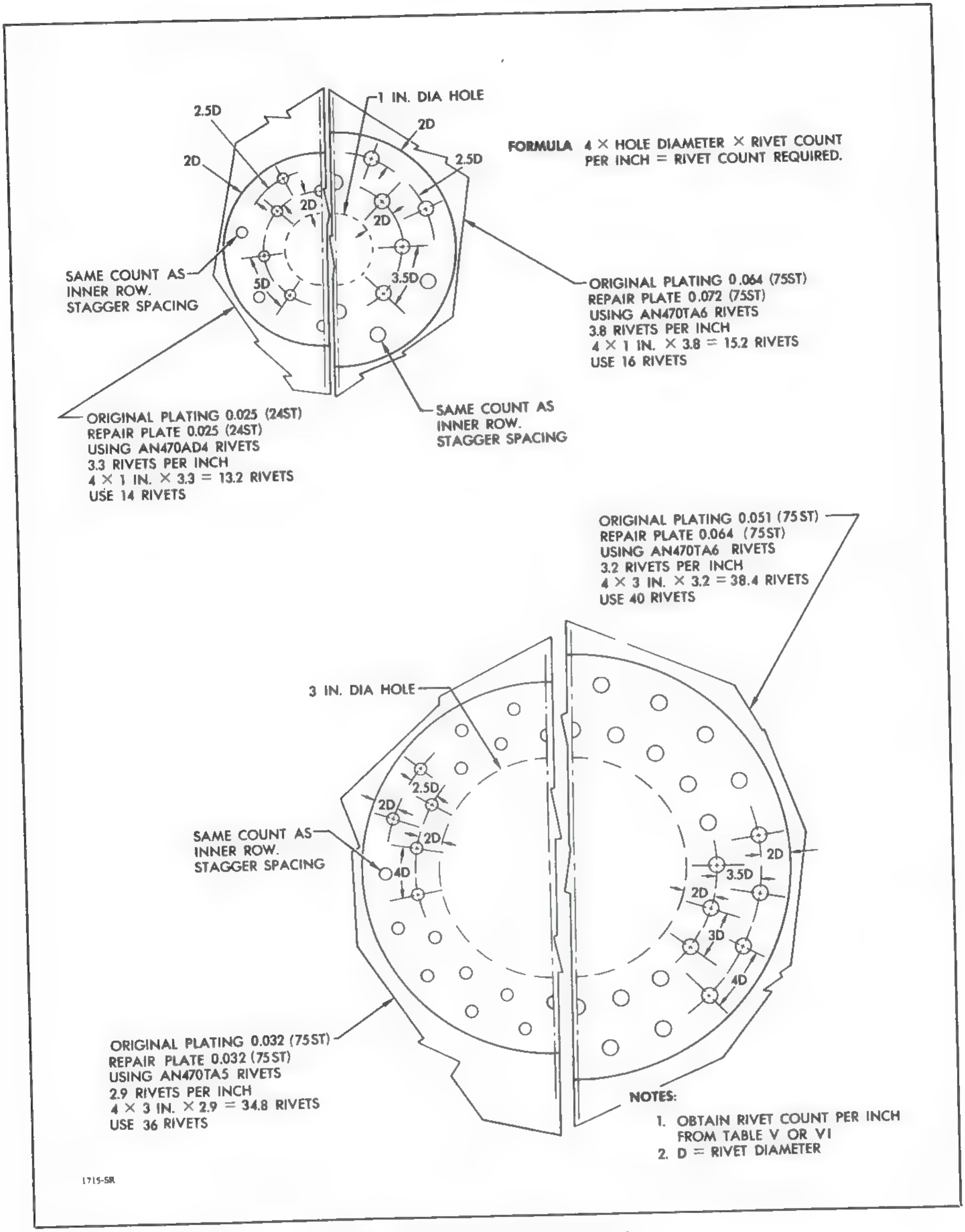
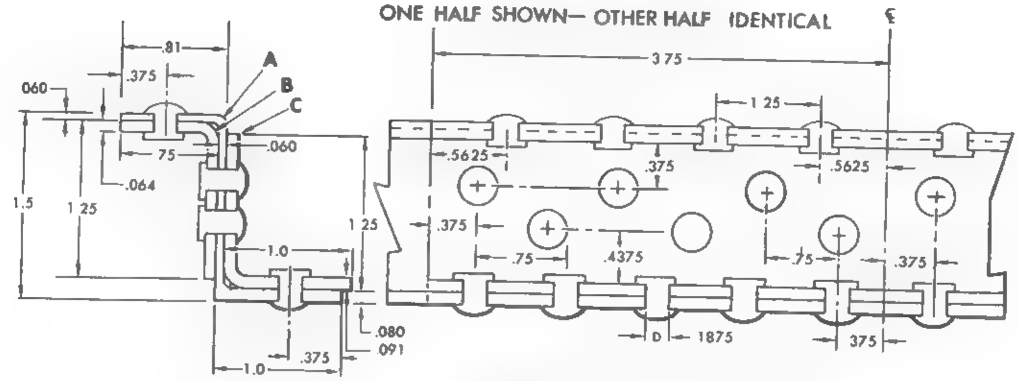


Figure 1-25. Round Plating Repairs



	MADE FROM	AREA	MATERIAL
A = STRUCTURAL MEMBER	K59224	0.216	75ST
B = SPLICE ANGLE	Y6-38	0.1213	75ST
C = SPLICE ANGLE	Y6-46	0.1874	75ST

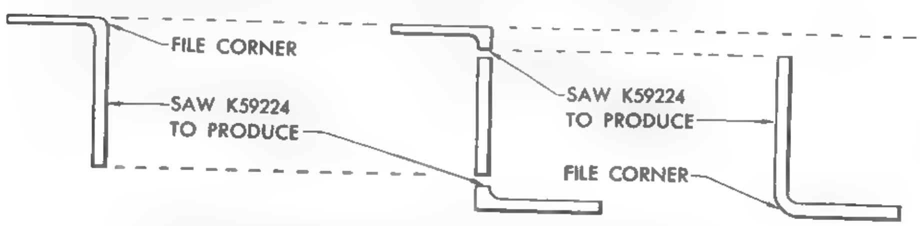
RIVET SELECTED, AN 470 TA6

1. DEVELOP "RIVET COUNT REQUIRED" FROM THE APPROPRIATE TABLE.
   UPPER FLANGE: 0.060 GAGE, 75ST, USING TA6 RIVETS. FROM TABLE VI.
   3.8 RIVETS PER INCH x 0.81" = 3.08 RIVETS. USE 4 RIVETS.
   WEB: 0.060 GAGE, 75ST, USING TA6 RIVETS. FROM TABLE VI.
   3.8 RIVETS PER INCH x 1.5 = 5.7 RIVETS. USE 6 RIVETS.
   LOWER FLANGE: 0.080 GAGE, 75ST, USING TA6 RIVETS. FROM TABLE VI.
   4.8 RIVETS PER INCH x 1.0 INCH = 4.8 RIVETS. USE 5 RIVETS.

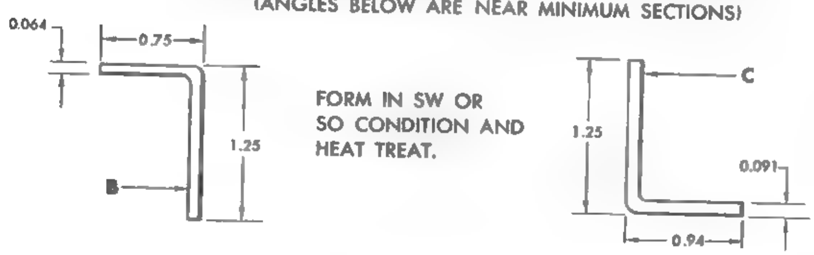
2. DEVELOP LENGTH OF SPLICE ANGLES REQUIRED.
   AS THE LOWER FLANGE REQUIRES 5 RIVETS WITHOUT STAGGER, DETERMINE THE LENGTH OF THE SPLICE AS FOLLOWS:
   2D EDGE DISTANCE AT 2 ENDS = 4D
   4D RIVET SPACING 4 SPACES = 16D
   TOTAL LENGTH OF ONE HALF SPLICE = 20D
   D = 0.1875" 20D = 20 x 0.1875 = 3.75". TOTAL LENGTH 7.5 INCHES.

ALTERNATE SPLICE MEMBERS

FABRICATE SPLICE ANGLES B AND C FROM A K59224 EXTRUSION



FABRICATE SPLICE ANGLES B AND C FROM 75ST SHEET STOCK
(ANGLES BELOW ARE NEAR MINIMUM SECTIONS)



1717-SR

Figure 1-26. Extruded Structural Member Splice

the filler to prevent buckling. In order to save weight in large flush patch installations, it may be desirable to remove the central portion of the back-up plate. It will then be serving as a doubler and the filler will be stressed. This will require that the same rivet pattern be used in attaching the filler to the doubler as in attaching the doubler to the original plate—this will be a repair by insertion.

1-67. SPLICING OF EXTRUDED OR FORMED STRUCTURAL MEMBERS. (See figure 1-26.)

1-68. SPLICE MEMBERS. When designing a repair for an extruded or formed structural member, deal with each flange as an individual member. Splice material should be the same as the original if possible. If substitution is necessary, splice members must have an equal or greater cross-sectional area than the original for each flange; see table 1-I. If sheet stock angles are used in splicing an extrusion, the area must be 5 percent greater. If a separate plate is required for one flange, as in a flanged "T" or "I" section, the area must be 15 percent greater. When two angles are used as splice reinforcements, as in figure 1-26, the legs reinforcing the web must be of sufficient length to permit riveting through both angles in the web area. Generally there are three alternatives in the selection of splice members:

a. Select a satisfactory existing formed section.

b. Modify an existing extrusion.

c. Fabricate a section out of sheet stock.

1-69. ATTACHMENT. Select a rivet diameter. If possible, copy the manufacturer's practice. As a general rule, a rivet diameter three times the thickness of the member, but never greater than 25 percent of the width of the member, will be satisfactory. Determine the rivet count required from the appropriate rivet table.

Four factors must be considered:

a. The material of the member.

b. The material and head type of the rivet.

c. The gage of the material.

d. The diameter of the rivet.

This will determine the number of rivets required on each side of the break. If a filler is used between the ends of the original member, the same rivet pattern must be carried through it, and the rivets required will be in addition to the count determined by the original formula. The length of the splice members must be sufficient to accommodate the required number of rivets while complying with minimum rivet spacing.

1-70. RIVET PATTERN. Decide the rivet pattern as follows: If the flanges of the member are equal in width and thickness, the pattern may conform to minimum rivet spacing. When flanges are unequal, the one with the larger rivet count will employ this pattern and the others will employ a symmetrical pattern of wider spacing. When width of a flange permits, staggering of rivets is desirable. When plating is to be attached to the member, the existing plating rivet pattern must be used on that flange and the splice angle must be of sufficient length to pick up the required number of rivets. The rivet shank diameter may be increased if pitch and edge distance permit.

1-71. CORROSION RESISTANT STEEL.

1-72. GENERAL. Corrosion resistant steel is used in the fabrication of wing and tail group thermal anti-ice leading edges and as a fire curtain between the power plant compartment and wing structure. In the latter capacity it is unstressed and any repair which will permit the part to function as a fire curtain will be satisfactory. Repair material and fasteners must be heat and corrosion resistant and all seams must be sealed to the extent of manufacturers seams in the area. Leading edge parts, as well as trailing edge skin in nacelle areas, are stressed to a certain extent and structural strength must be considered in their repair. Use corrosion resistant steel. Specification MIL-S-5059, composition 301, ½ hard, for skin repairs and corrosion resistant steel, Specification MIL-S-5059, composition 302, annealed for liner and baffle repairs.

1-73. SPOT WELDS. Cracked spot welds shall be repaired by drilling rivet holes centered on the spot weld and installing corrosion resistant steel rivets. (For rivet shank diameter to install, see table 1-XI.)

Gage thinnest member	Q4304 or Q4310 rivets
0.008 to 0.016	Use -C3 rivets
0.020 to 0.025	Use -C4 rivets
0.030 to 0.042	Use -C5 rivets
0.051 to 0.063	Use -C6 rivets

Use same count rivets as spotwelds being replaced. Using thinnest member being joined (excepting skin), determine rivet diameter from this table. For attaching skin only, use -C3 rivets.

Table 1-XI. Substitution of Rivets for Spotwelds in Corrosion Resistant Steel Leading Edge

1-74. REPLACEMENT OF PARTS. Due to the relatively short length of members, damaged parts will usually be replaced. Remove damaged parts by drilling through the center of the spot welds, using a sharp drill about 0.010 inch under the hole size desired for rivet installation. (Determine rivet diameter from table 1-XI.) Install the same number of corrosion resistant steel rivets as spot welds in the original pattern.

1-75. FIBERGLAS.

1-76. GENERAL. This subject is thoroughly covered in NAVAER Technical Order No. 01-1A-501, entitled Fabrication and Repair of Reinforced Plastics. It deals

with fiberglas of sandwich type and non-sandwich type construction. It covers plastic repair of fiberglas material of honeycomb type sandwich construction as used in the bow radome and the pilots' canopy afterbody mentioned in Section IV. Repairs described in this specification also apply to the following three locations where the fiberglas material is of the non-sandwich type, namely, in the vertical stabilizer tip, rudder tip, and the large rectangular fiberglas access doors on each side of vertical stabilizer. There is radar equipment installed in the three locations just mentioned. Radar equipment is also installed in the left horizontal stabilizer of the R3Y-2 only, with a fiberglas access panel on the lower surface near the tip. At these locations, fiberglas can only be repaired or replaced with fiberglas. Fiberglas of non-sandwich construction constitutes a skin built up of layers of resin-bonded fiberglas which, because of the presence of radar equipment, must be void-free. Void freedom means that no air bubbles or entrapped air is permitted to exist between the resin-bonded layers of fiberglas cloth in these particular locations.

1-77. FIBERGLAS REPAIRS WITH METAL. Fiberglas is used in other locations where metallic repairs may be made. These locations are tail group trailing edge caps, nacelle fairings and thermal anti-ice leading edge aft baffle. Patches of corrosion resistant steel may be applied to the leading edge aft baffle, using corrosion resistant steel rivets. In the remaining instances patches of sheet aluminum may be used and applied with "B" aluminum rivets. Light washers must be installed between the fiberglas and the shop head of the rivets. It is only necessary that the rivet pattern produce a tight seam.

1-78. DISSIMILAR METALS.

1-79. GENERAL. Certain metals, when in contact with each other, show a very unsatisfactory resistance to corrosion when in the presence of moisture, and especially salt water. As this airplane is expected to operate from salt water, this factor is especially important. The metals used in it are arranged in four groups below. The metals within a group are not dissimilar in reaction. Metals in the more widely separated groups are the most dissimilar and the reaction is more pronounced.

Group I	Magnesium and its alloys.
Group II	Cadmium, zinc and aluminum and their alloys.
Group III	Iron, lead and tin and their alloys (except corrosion resistant steel).
Group IV	Copper, chromium, nickel, silver, gold, platinum, titanium, cobalt and rhodium and their alloys, plus corrosion resistant steel and graphite.

1-80. CORROSION PREVENTATIVE MEASURES. To minimize corrosion, the following precautions should be employed in all repairs:

a. Steel bolts, screws, nuts, and washers must be cadmium plated.

b. Bolts and nuts must be installed with a steel and an aluminum washer at each end, with the aluminum washer against the structure. They should be coated with vinyl zinc chromate primer and assembled wet.

c. All aluminum repair parts, and the structure to which it is to be assembled, should be thoroughly cleaned with Methyl Ethyl Ketone, treated with chromic acid and given a coat of wash prime and a coat of vinyl zinc chromate primer before assembly. After assembly, any scratches and rivet heads should be touched up with vinyl zinc chromate primer and followed with a spray coat of the same before application of exterior or interior finish.

d. Corrosion resistant steel rivets installed below the hull floor level must be coated with vinyl zinc chromate primer and driven wet.

e. When dissimilar metals are to be permanently attached together, each faying surface must be given two coats of vinyl zinc chromate primer before attachment.

f. If one of the dissimilar metals is magnesium, each faying surface must be given three coats of vinyl zinc chromate primer before attachment. If zinc chromate tape is installed between the faying surfaces, each surface need only be given two coats of primer.

g. Steel bushings installed in aluminum structure or fittings must be a tight press fit and installed with wet vinyl zinc chromate primer.

1-81. CONTROL SURFACE BALANCE. (See figure 1-27 for tolerances, methods and equipment for checking balance.)

1-82. GENERAL. Control surfaces must be maintained in a balanced condition for all flight operations. Static balance should be checked when:

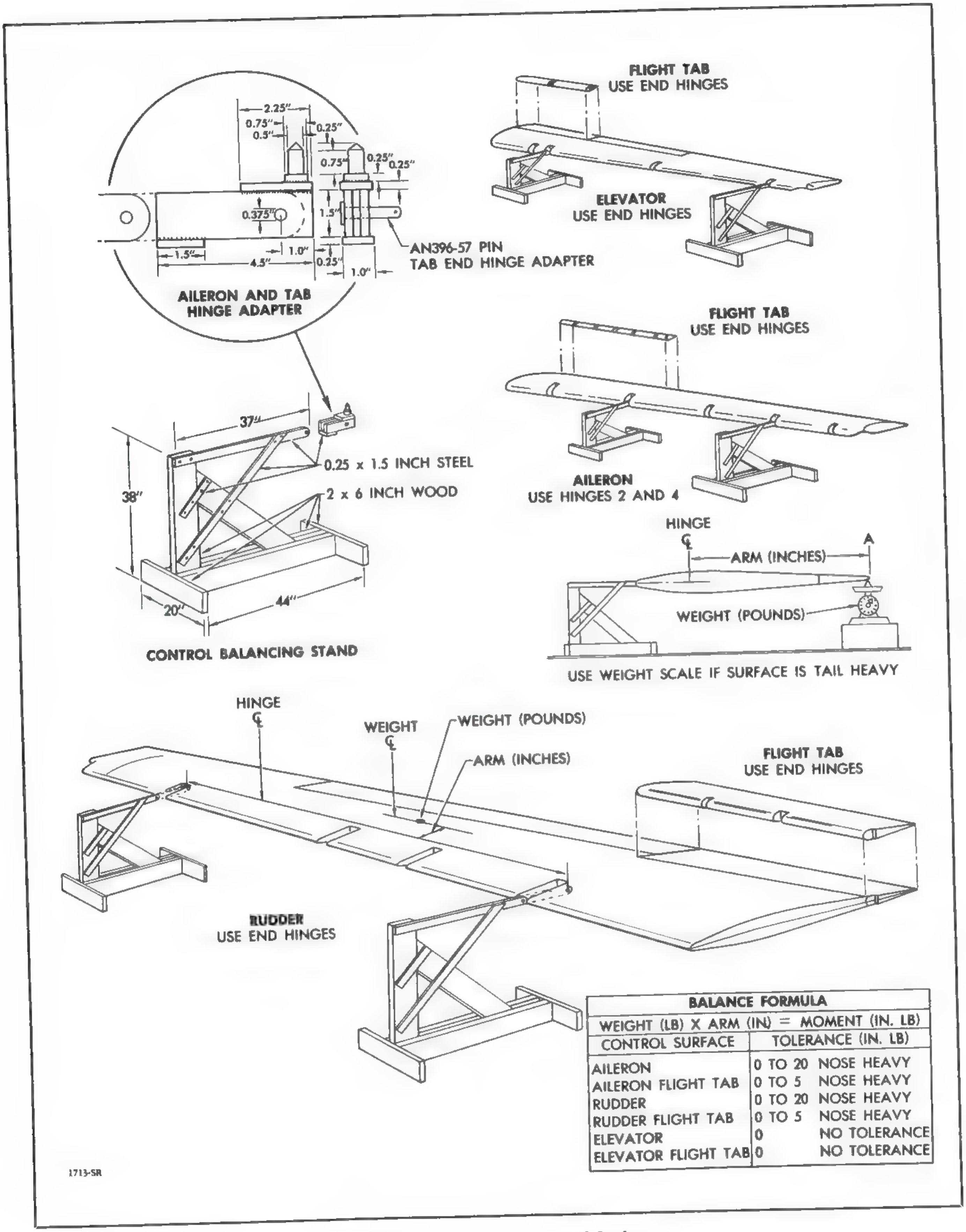
a. A repair has been accomplished which might have changed the weight of any part of the assembly.

b. Any component of the assembly has been replaced.

c. Any or all of the components of the assembly have been refinished.

d. Unsatisfactory flight operation has been reported.

1-83. BALANCE REQUIREMENTS. Each aileron, elevator, and the rudder must balance within tolerances when equipped with its control and trim tabs and their actuating mechanism. Each control tab must balance in itself before attachment to the main control surface. Trim tabs do not require balancing but any work on them or replacement will require checking the balance of the main control surface. Corrections are made by adding or removing counter-balance weights located in the leading edge of each unit. Any repair or replacement requiring the addition of more than 10 percent of the original weight in an area will require engineering approval. Balance of a control surface shall be checked by mounting in a horizontal jig as shown in figure 1-27.



BALANCE FORMULA	
WEIGHT (LB) X ARM (IN) = MOMENT (IN. LB)	
CONTROL SURFACE	TOLERANCE (IN. LB)
AILERON	0 TO 20 NOSE HEAVY
AILERON FLIGHT TAB	0 TO 5 NOSE HEAVY
RUDDER	0 TO 20 NOSE HEAVY
RUDDER FLIGHT TAB	0 TO 5 NOSE HEAVY
ELEVATOR	0 NO TOLERANCE
ELEVATOR FLIGHT TAB	0 NO TOLERANCE

Figure 1-27. Balancing Control Surfaces

1-84. NOSE HEAVY. If the control surface is nose heavy, the amount or moment may be determined by applying a known weight on the upper surface aft of the hinge line. When balanced, measure the distance from the hinge center to the weight center line. Distance times weight equals the moment of nose heaviness in inch pounds. If this moment is not within tolerance, remove some weight from the counter-weight. The amount may be determined by measuring the distance between the hinge center line and the point where weight is to be removed. If this distance in inches is divided into the moment (inch pounds nose heavy) the result obtained will be the weight to remove in pounds.

1-85. TAIL HEAVY. If the control is tail heavy, the moment may be determined by the use of a balance scale as shown in figure 1-27. The distance in inches from the hinge center line to the point of contact with the scale, times the reading of the scale in pounds, will give the tail heavy moment in inch pounds. Determine the weight in pounds which must be added to the counter-weight as described in paragraph 1-84.

1-86. BALANCE BY COMPUTATION. This method of returning a control to its original balance condition, after a repair, is of value when facilities are not available to check the balance by the former method. It may be used when a repair has been accomplished without removal of the control from the airplane and, if carefully done, is satisfactory. It is not recommended as a general practice as the surfaces are large and the tolerances small. Application of exterior finish only may considerably affect the balance and cannot be satisfactorily computed. To employ it, proceed as follows:

a. Weigh the materials that have been removed during the repair. Weigh the materials and parts (after they have been cut to size) that are to be used in making the repair.

b. Subtract the weight of the materials being removed, from the weight of the materials being installed.

c. Measure the distance, in inches, from the hinge line to the center of the repair.

d. Multiply the distance by the weight difference (in pounds) obtained in step b. The result is the number of inch-pounds that the surface balance has changed during the repair.

e. Divide the value obtained in step d., by the distance, in inches, from the hinge line to the point where the counter-weight correction is to be made (leading edge). The resultant figure is the number of pounds that will have to be added to or subtracted from the leading edge counter-balances.

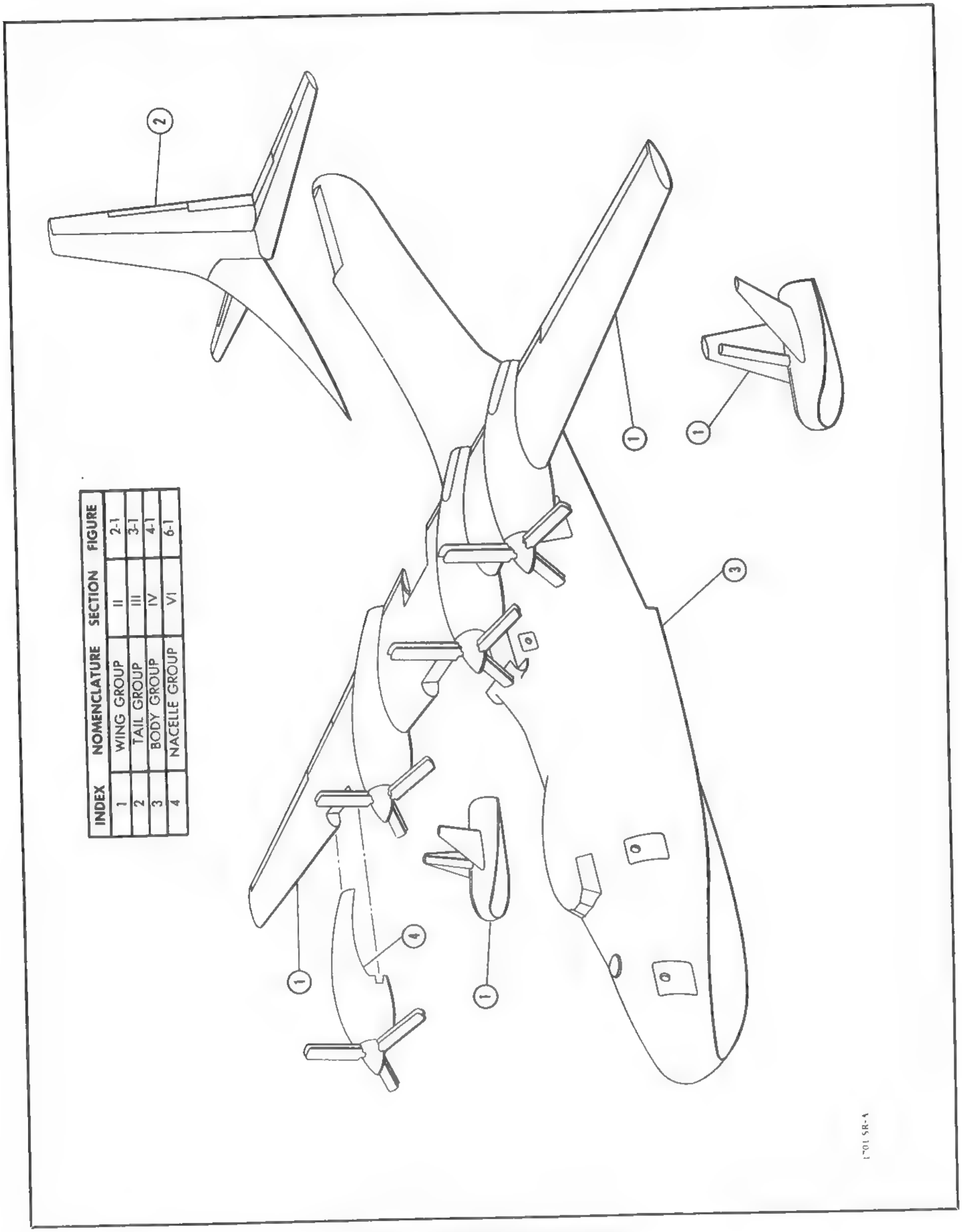
f. If the repair is aft of the hinge line, add the weight to the leading edge in the area determined by the center line of the repair. If the repair is forward of the hinge line, subtract the weight from the leading edge in the same area.

NOTE

In the calculating procedure, it has been assumed that the repair would result in an increased weight at the repair point. If, for any reason, the repair results in decreased weight (removal of an assembly, etc.), reverse the instructions given in step f., that is, subtract the weight if the repair is aft of the hinge line, and add the weight if the repair is forward of the hinge line.

1-87. Balancing of control tabs must always be accomplished first, followed by balancing of the control to which it is attached. Balancing of the main control may be done by computation after tab repair, replacement, refinish or balancing. Weigh the tab as removed and as ready for installation. The difference in weight of a control tab shall be computed at its hinge center line. That of a trim tab shall be computed at the center of the weight change.

1-88. MAJOR COMPONENTS. (See figure 1-28.) The airplane is composed of five major component groups: wing group, tail group, body group, and nacelle group. A detailed breakdown of each component and its repair is included in the applicable section.



INDEX	NOMENCLATURE	SECTION	FIGURE
1	WING GROUP	II	2-1
2	TAIL GROUP	III	3-1
3	BODY GROUP	IV	4-1
4	NACELLE GROUP	VI	6-1

Figure 1-28. Major Components

SECTION II

WING GROUP

2-1. GENERAL. The wing is of full cantilever, stressed skin construction. The interspar structure is the major load bearing component to which the other components are attached. (See figures 2-1 and 2-2.) These components are leading edge, trailing edge, tip, flaps, aileron with control and trim tabs, and auxiliary float assembly.

2-2. WING INTERSPAR STRUCTURE. (See figures 2-3, 2-4, and 2-5.)

2-3. GENERAL. The wing interspar structure is fabricated of 75ST aluminum alloy throughout and consists basically of front and rear spars, chordwise bulkheads and spanwise stringers to which the stressed skin is riveted, forming a rugged box beam. It is divided into a center section and two outer panels with the panel splices located at rib station 17, left and right. Each outer wing panel has mounting provisions for the optional installation of an in-flight refueling pod. The entire area between rib station 12 left and right comprises the integral fuel tank area. Four engine nacelles and two auxiliary floats are attached to this structure. Mounting provisions for the optional installation of an in-flight refueling pod are adjacent to each outboard nacelle. This is the most highly stressd part of the structure and repairs, with the exception of replacing of rivets and minor attached parts, should not be attempted without engineering action. (Refer to paragraph 2-12 and subsequent for integral fuel tank repair information.)

2-4. SPARS. The spars are built up "I" beams, with webs of alclad sheet, rails of machined and tapered extrusions and extruded stiffeners. In the fuel tank area all repairs must be designed to meet fuel-tight as well as structural requirements.

2-5. BULKHEADS. The bulkheads are of the three following basic types:

a. *Fuel-Tight Bulkhead.* Solid web of alclad sheet reinforced by extruded stiffeners and extruded rails, to which skin is attached directly. These bulkheads are equipped with forged dagger fittings for the attachment of stringers. All faying surfaces are insulated by fairprene sheet to insure fuel-tightness. Any repair must be fuel-tight as well as meet structural requirements.

b. *Baffle Type Bulkhead.* These bulkheads are much the same as fuel-tight bulkheads in construction. However, stringers pass over the rails and attach to them, while the skin is attached to the stringers and intercostals located between the stringers. Repairs to the solid web need not be fuel-tight.

c. *Truss Type Bulkhead.* These bulkheads consist of extruded rails and diagonal members. Attachment of stringers and skin is the same as for baffle type bulkheads.

2-6. STRINGERS. These spanwise structural members are machined from extruded "Z" and flanged "T" shapes. They are tapered and vary in shape and cross-sectional area. (See figure 2-6 for stringer specifications. Print numbers are listed as the only source of information concerning cross-section at any point except by direct measurement.) They are spliced at each fuel-tight bulkhead by forged dagger fittings which pass through the bulkhead. They are connected at the panel splice by half dagger fittings attached to each stringer, through which internal wrenching bolts pass.

2-7. SKIN. The skin of the interspar structure is highly stressed and varies in gage with location. (See figure 2-7 for seams and gages.) Some of these panels are tapered in thickness by machining. The machined panels are installed with the machined surface on the exterior, consequently a check for depth of scratches as prescribed in paragraph 1-38 would not be applicable. The skin is attached to spars, stringers, and bulkheads with 100° countersunk head fasteners except where hidden as through the nacelle and hull sections. All seams are flush and are reinforced with internal doublers. Corrosion resistant steel rivets and Huck lockbolts are very generally used due to the heavy gages and high stresses involved throughout the interspar structure.

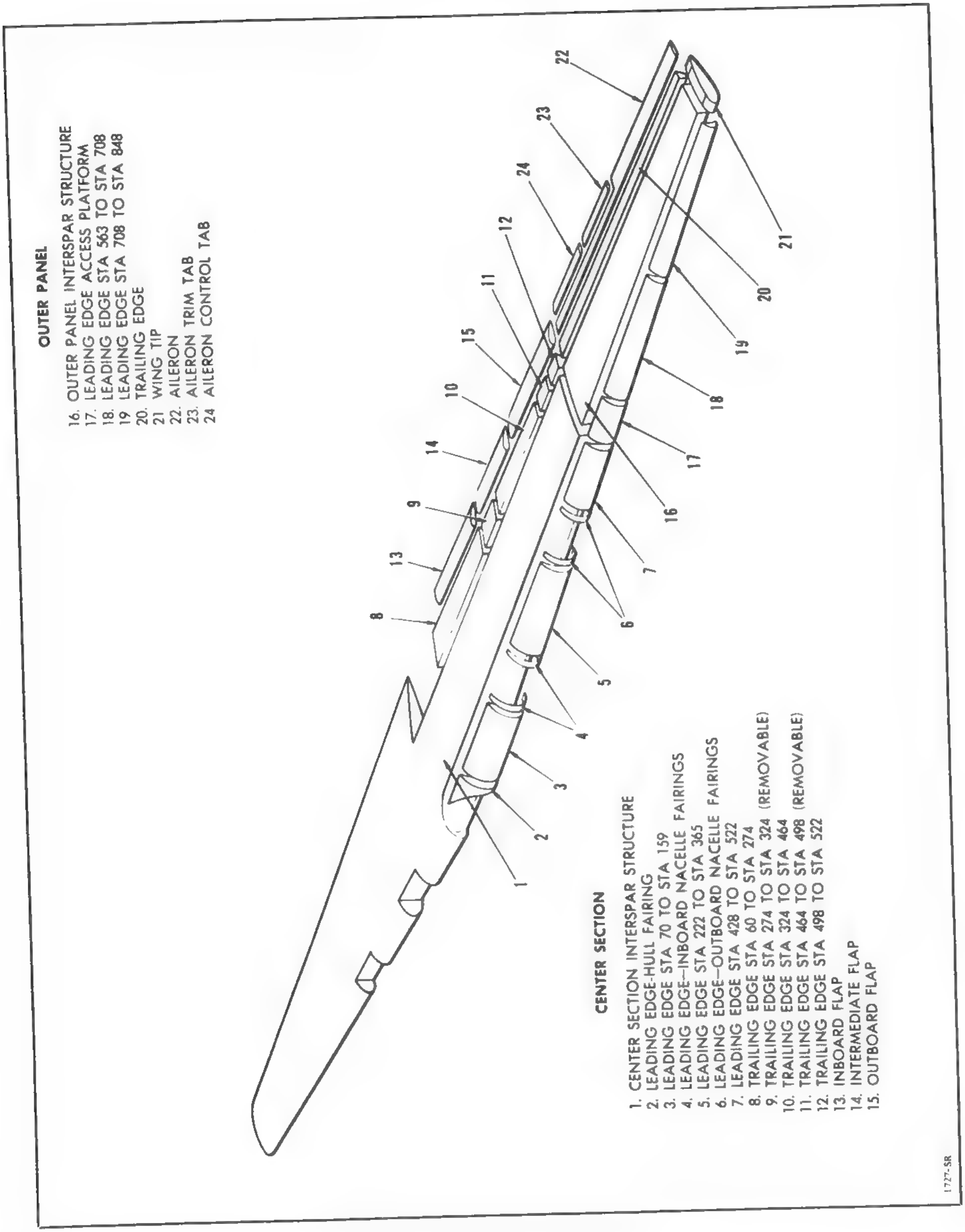


Figure 2-1. Wing Components

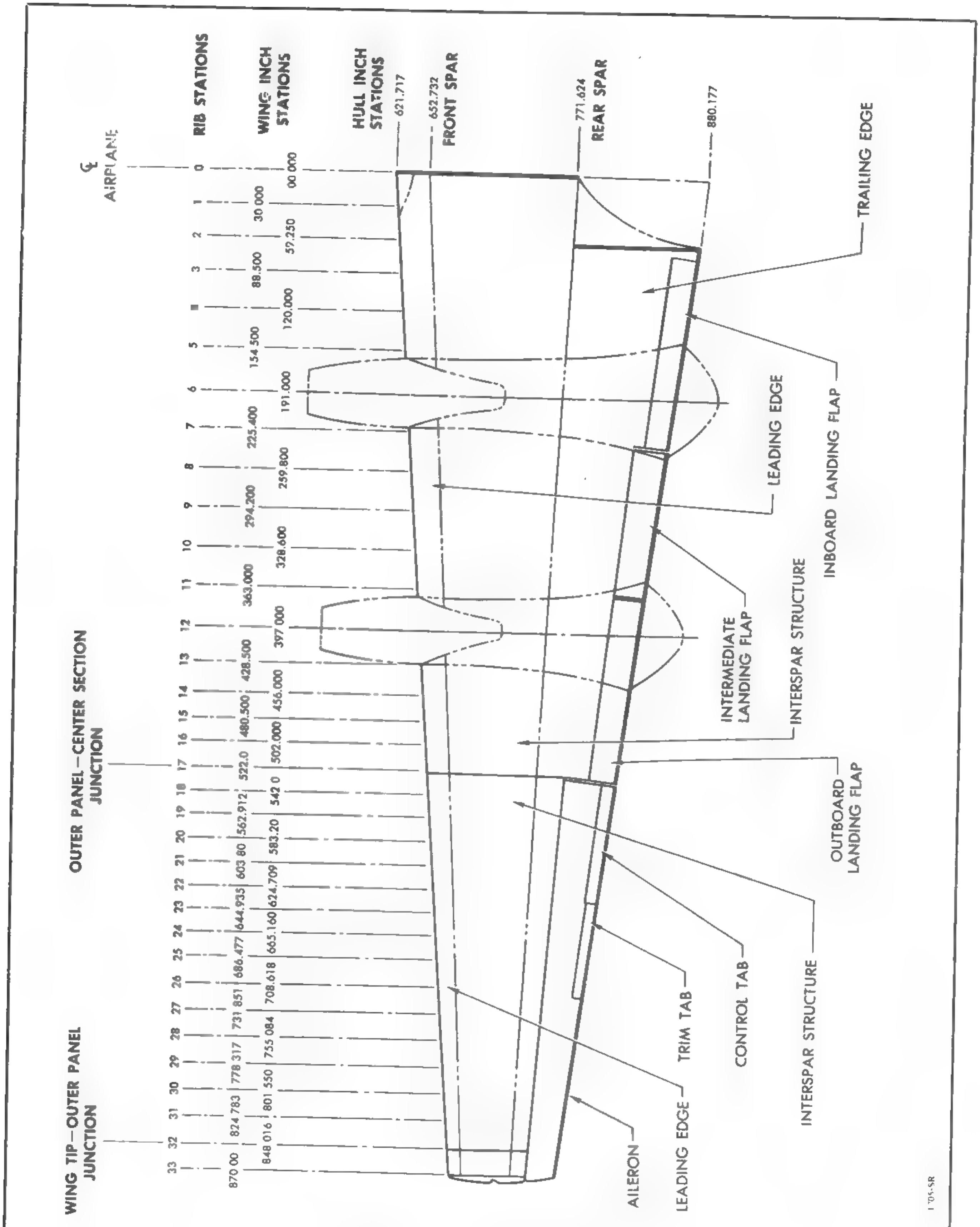


Figure 2-2. Wing Stations

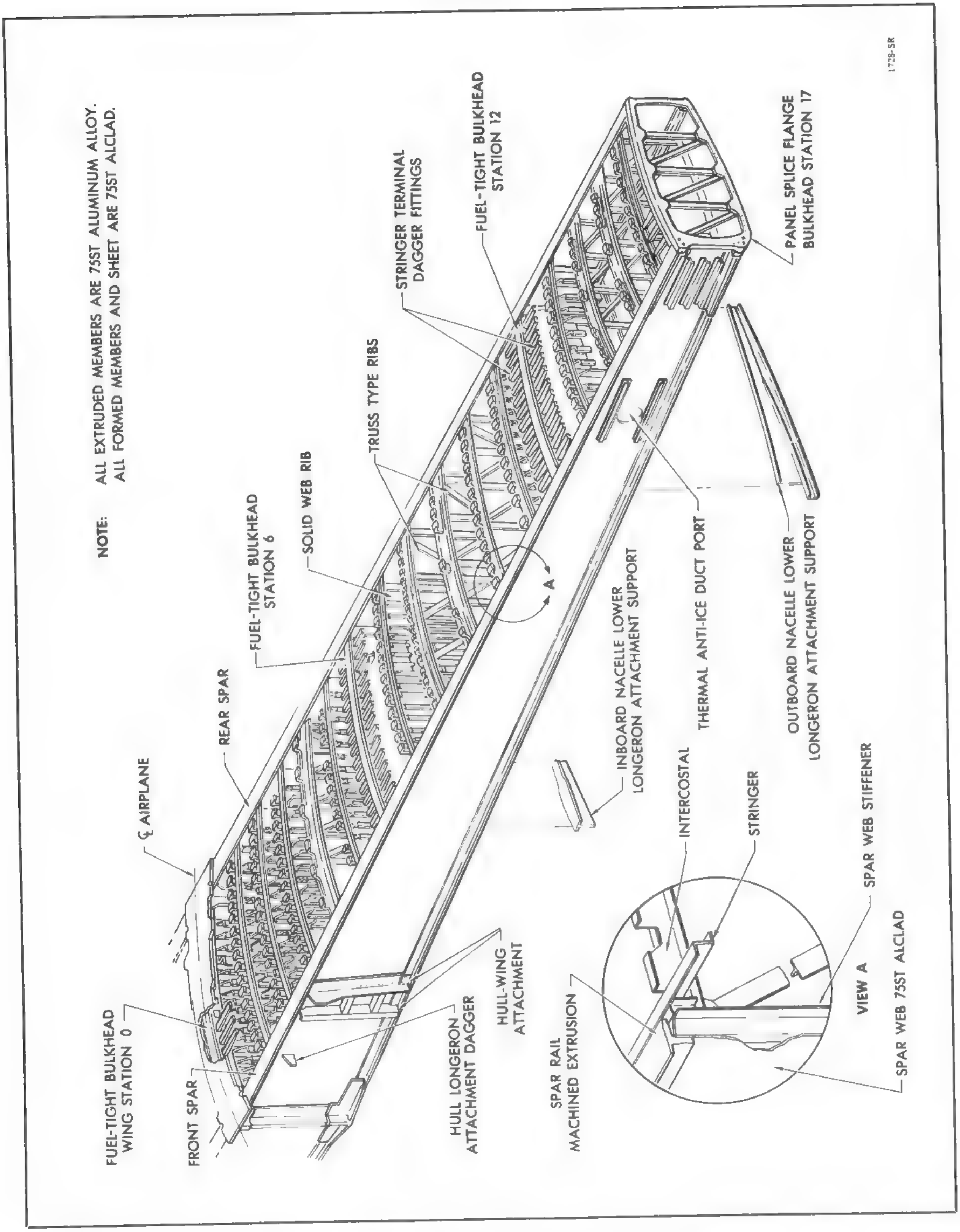


Figure 2-3. Wing Center Section Interspar Structure

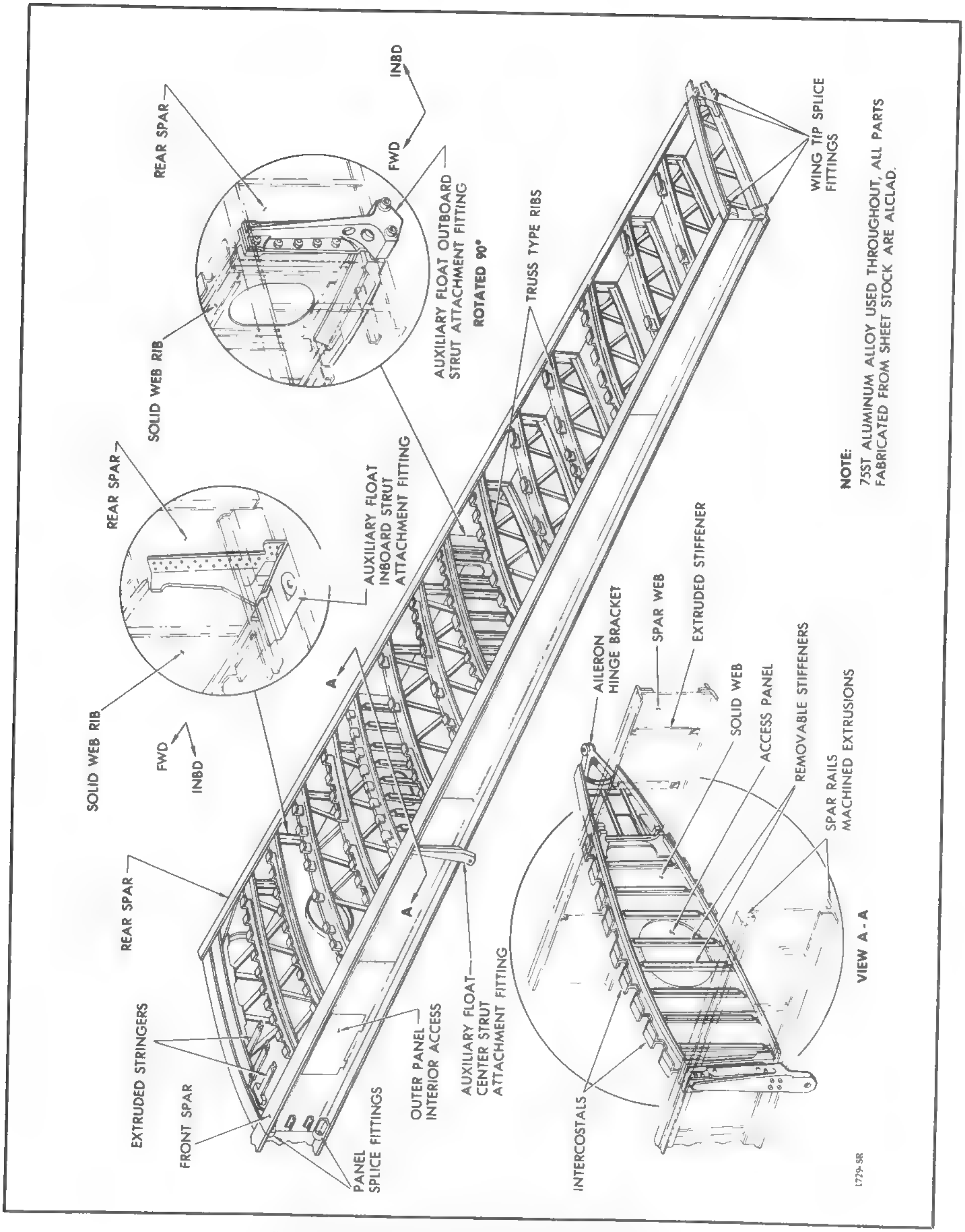


Figure 2-4. Wing Outer Panel Interspar Structure

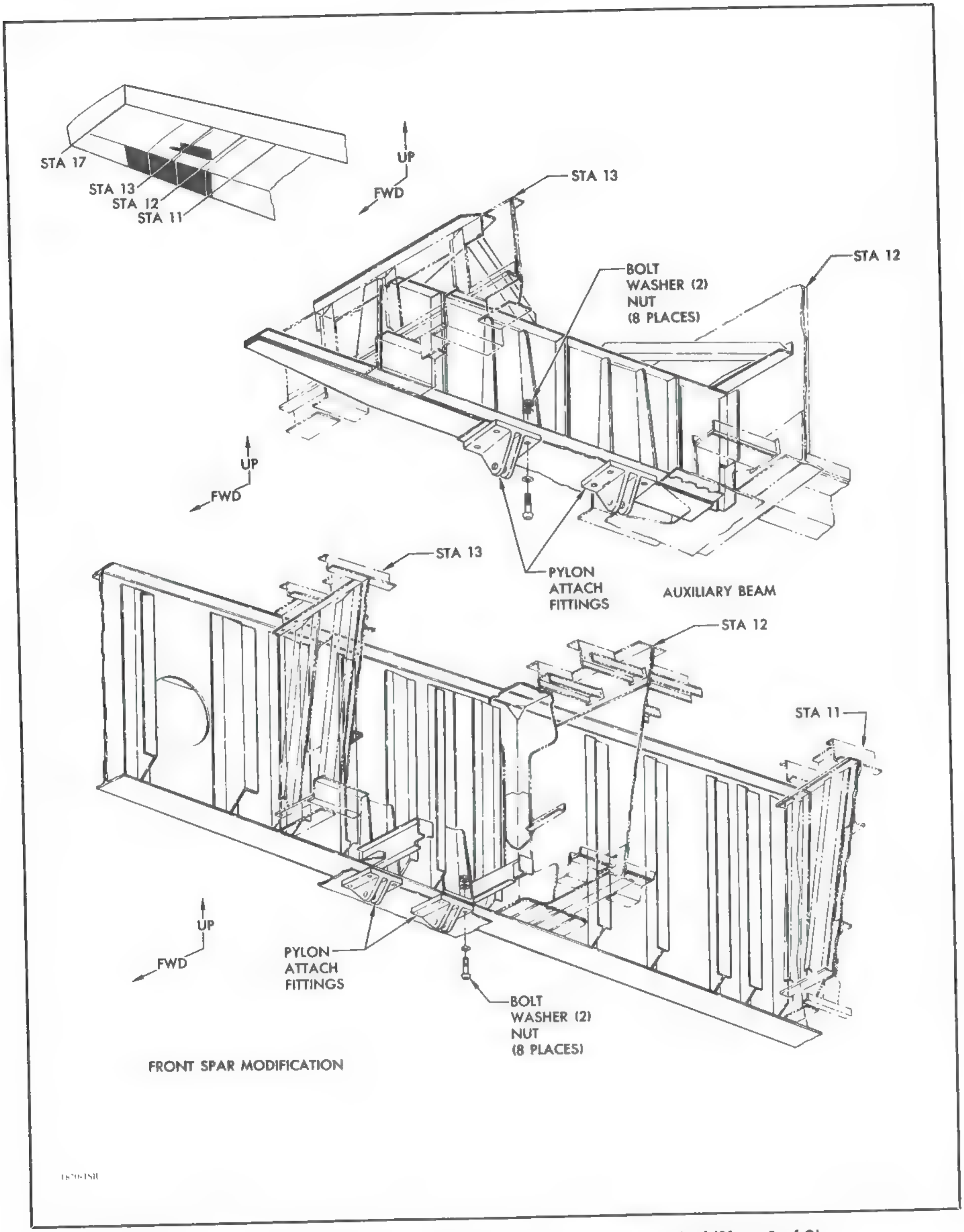


Figure 2-5. In-Flight Refueling Pod Wing Spar Components, Typical (Sheet 1 of 2)

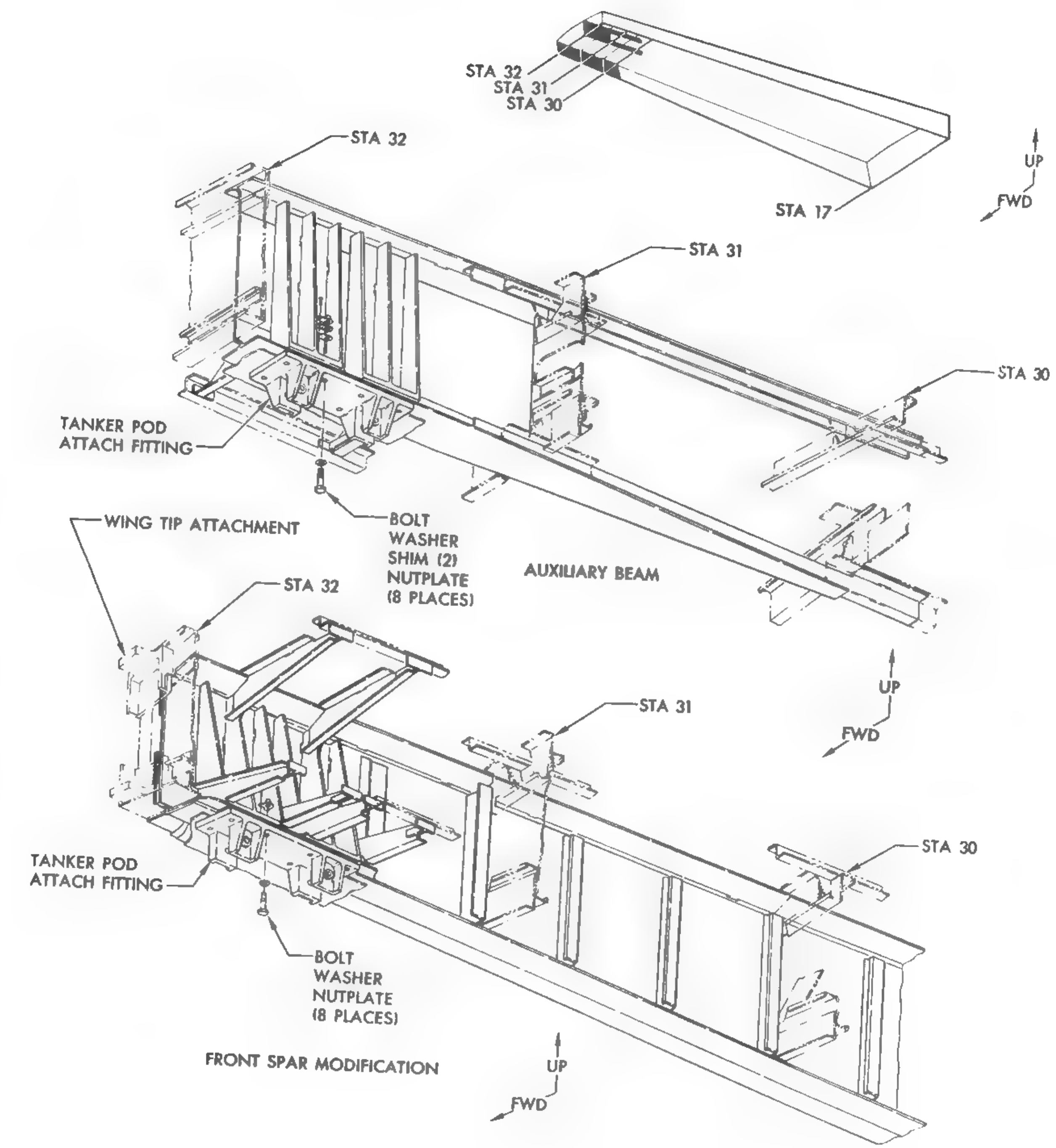
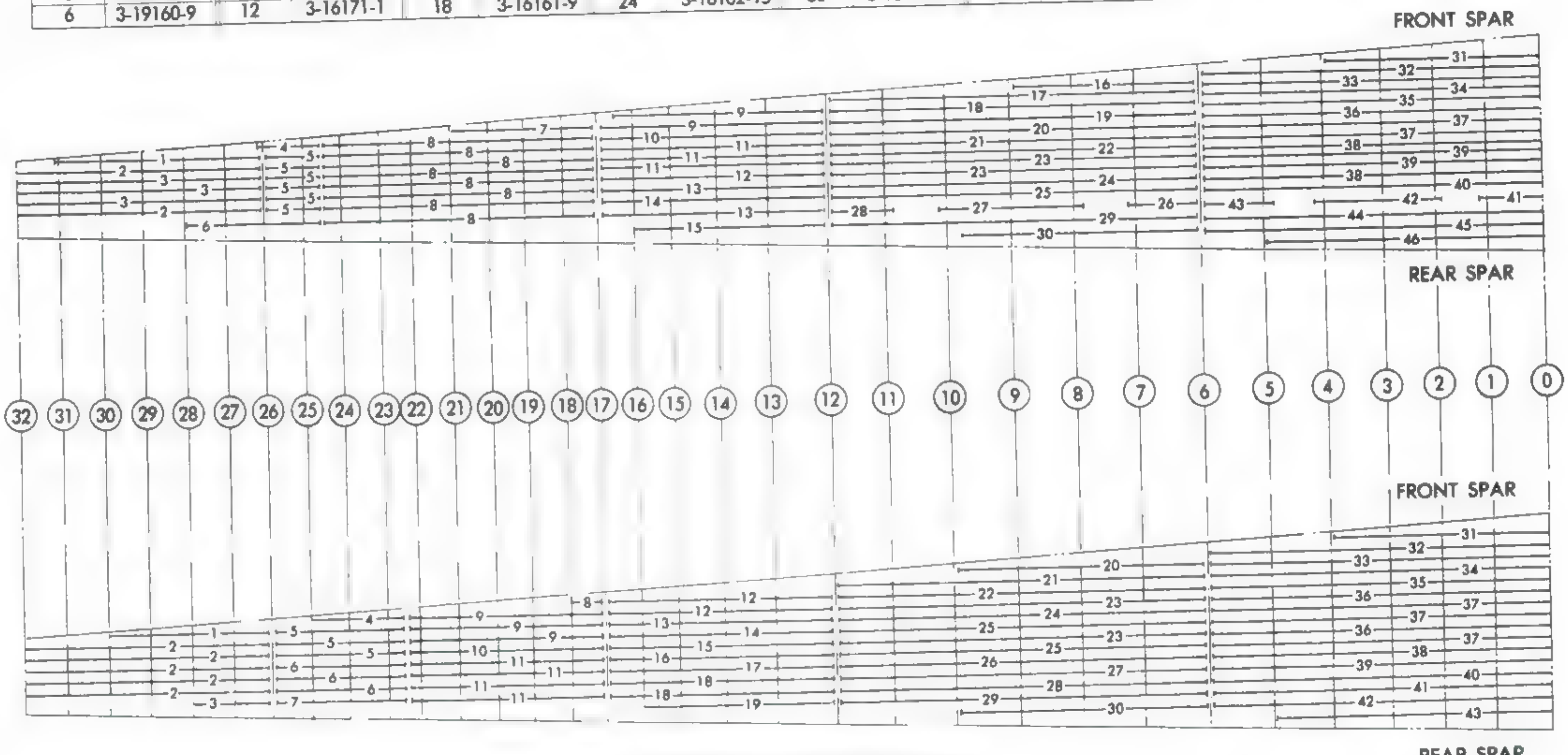


Figure 2-5. In-Flight Refueling Pod Wing Spar Components, Typical (Sheet 2 of 2)

UPPER SURFACE STRINGER INDEX

INDEX NO.	DRAWING NUMBER	INDEX NO.	DRAWING NUMBER	INDEX NO.	DRAWING NUMBER	INDEX NO.	DRAWING NUMBER	INDEX NO.	DRAWING NUMBER	INDEX NO.	DRAWING NUMBER	INDEX NO.	DRAWING NUMBER	INDEX NO.	DRAWING NUMBER
1	3-19156-9	7	3-19161-9	13	3-16170-1	19	3-16175-3	25	3-16163-11	31	3-16173-9	37	3-16159-13	42	3-16176-9
2	3-19157-11	8	3-19162-9	14	3-16170-3	20	3-16162-9	26	3-16169-7	32	3-16178-9	38	3-16159-15	43	3-16176-13
3	3-19157-13	9	3-16172-3	15	3-16198-1	21	3-16162-11	27	3-16169-9	33	3-16158-13	39	3-16174	44	3-16160-15
4	3-19169-9	10	3-16172-1	16	3-16190-7	22	3-16162-13	28	3-16169-11	34	3-16158-17	40	3-16160-7	45	3-16177
5	3-19159-9	11	3-16171-11	17	3-16191-7	23	3-16179-7	29	3-16163-9	35	3-16158-21	41	3-16176	46	3-16189
6	3-19160-9	12	3-16171-1	18	3-16161-9	24	3-16162-15	30	3-16177-9	36	3-16175				



LOWER SURFACE STRINGER INDEX

INDEX NO.	DRAWING NUMBER	INDEX NO.	DRAWING NUMBER	INDEX NO.	DRAWING NUMBER	INDEX NO.	DRAWING NUMBER	INDEX NO.	DRAWING NUMBER	INDEX NO.	DRAWING NUMBER	INDEX NO.	DRAWING NUMBER	INDEX NO.	DRAWING NUMBER
1	3-19164-9	7	3-19167-59	13	3-16140-1	19	3-16144-7	24	3-16154-13	29	3-16155-9	34	3-16150-101	39	3-16181
2	3-19165-9	8	3-19168-9	14	3-16140-3	20	3-16196-3	25	3-16154-11	30	3-16193-7	35	3-16183	40	3-16186
3	3-19158-9	9	3-19168-11	15	3-16141-1	21	3-16192-9	26	3-16154-101	31	3-16180	36	3-16182-3	41	3-16152-105
4	3-19167-9	10	3-19168-13	16	3-16142-1	22	3-16116-1	27	3-16195	32	3-16187	37	3-16151-15	42	3-16152-109
5	3-19167-15	11	3-19173-7	17	3-16142-9	23	3-16188-1	28	3-16194	33	3-16182	38	3-16151-17	43	3-16184
6	3-19167-61	12	3-16140-5	18	3-16143-9										

1726-5R

Figure 2-6. Wing Stringer Diagram

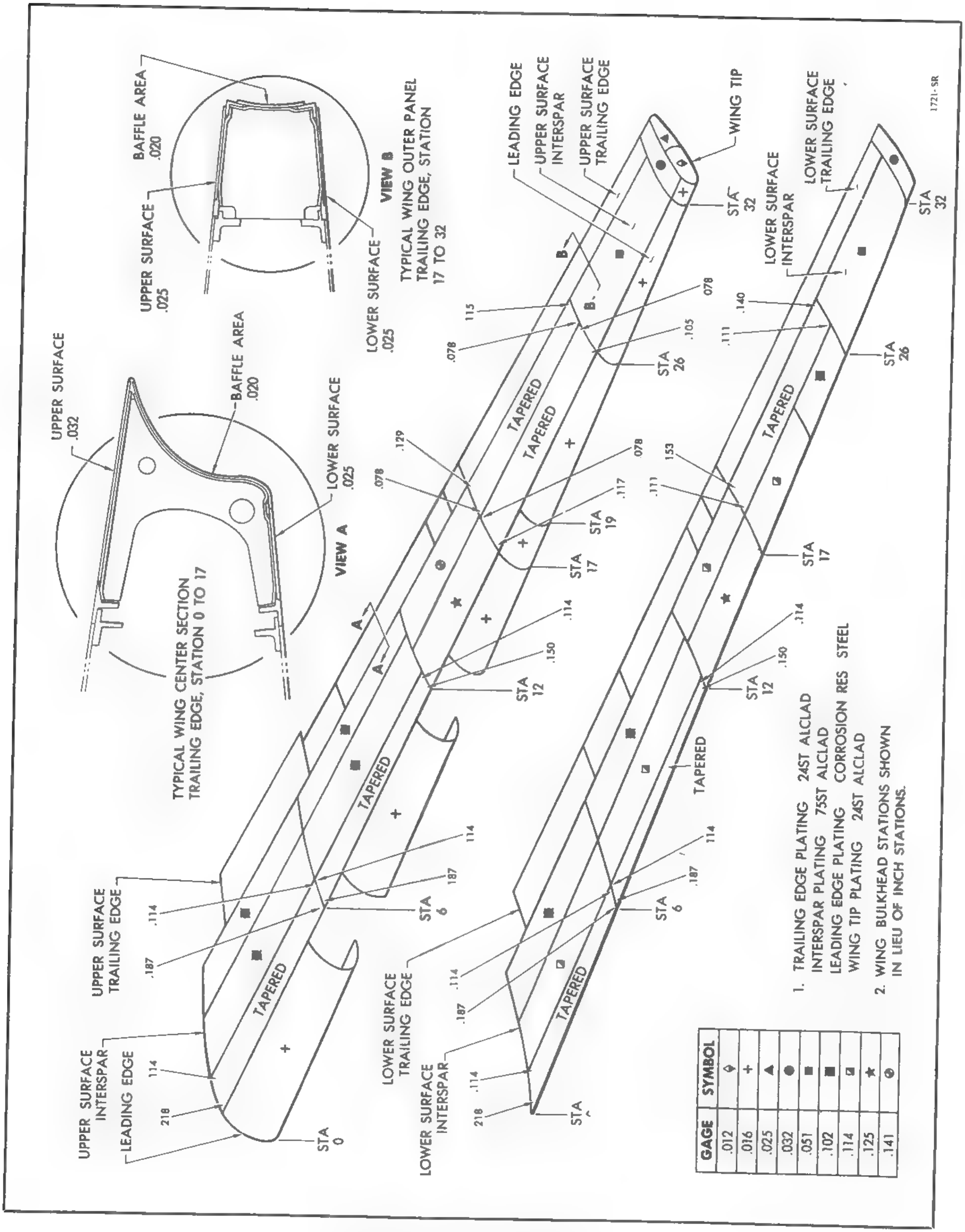


Figure 2-7. Wing Plating Diagram

2-8. NEGLIGIBLE DAMAGE. Due to the highly stressed condition of the interspar structure, damage considered negligible will be limited to minor scratches, nicks, and dents. Spar rails, stringers, and skin in or near seam rivet patterns are especially important. (Refer to paragraph 1-38 for aid in evaluation of damage.)

2-9. DAMAGE REPAIRABLE BY PATCHING. Skin repairs should be flush type to maintain the smooth contour whenever possible. However, due to the close spacing of stringers, most skin repairs will need to be surface patches. Bevel edges and use 100° countersunk rivets. Spar and bulkhead webs may be repaired as described in Section I and Appendix II. Obtain engineering approval when repairs involve the spar rails, bulkhead rails, or stringers.

2-10. DAMAGE REPAIRABLE BY INSERTION. Obtain engineering approval for damages requiring this type of repair.

2-11. DAMAGE NECESSITATING THE REPLACEMENT OF PARTS. Fittings, stiffeners, and intercostals should be replaced if damaged beyond the limits of negligible damage. Any substitutions require engineering approval.

2-12. FUEL TANK MAINTENANCE.

2-13. GENERAL. The entire wing interspar area between outboard nacelle centerlines, bulkhead 12, left and right, is fuel tank area. Front and rear spars, as well as upper and lower skins, form walls of this storage space. Rib station 12, left and right, form the ends. This space is divided into four compartments by rib station 6, left and right, located at the inboard nacelle centerlines, and rib station 0, located at the wing centerline. Any repairs or replacements of these elements or attaching parts must return the area to its original fuel-tight condition as well as develop the full strength of the structure. Fuel leaks may occur due to poor workmanship in maintenance, loosening of fasteners due to vibration and strain in service, or failure of parts due to fatigue or accident. The purpose of this section is to aid in the inspection and repair needed to maintain the airplane in airworthy condition.

2-14. MANUFACTURING PRACTICES. Refer to Appendix I, Repair Materials, for specifications and handling information concerning parts, sealants and solvents referred to in this section.

2-15. GASKETS. Fairprene sheeting No. M5570, 0.032 inch thick is installed between faying surfaces of all elements of spars, skins and fuel-tight bulkheads through which fasteners pass from the wet to the dry side of the member. This is true of externally attached members such as spar stiffeners and reinforcements as well as internal members. This gasket covers the entire faying surface and may protrude a maximum of 0.093 inch. The gasket is omitted under the flap support brackets at rib stations 8 and 10. The bolt holes are countersunk at the face of the fitting which is against the structure and rubber "O" rings installed on the bolts to fit in the countersink. (See figure 2-8.)

2-16. FASTENERS. In manufacture all rivets are installed without a sealant. If rivets have been replaced, the head may have been swabbed with sealer EC801, and driven wet. Concealed rivets, located where redriving is impossible, have the fuel side coated with void sealer, EC801, and overcoated with coating Type I (EC776 colored with red aniline dye). Dome type plate nuts are sealed in the same manner. Rubber faced seal washers No. 4018A are installed under the head and nut of AN bolts, NAS screws and Huck lockbolts when used in a fuel-tight application except no washer is used under countersunk type heads. Huck lockbolts with countersunk type head have the washer under the collar only. (See figure 2-9.) Pull type Huck lockbolts with the collar on the wet side are treated with chromic acid and sealed with one coat of colored cement, EC776. Stump type Huck lockbolts receive one coat of cement, EC776, only. (See figure 2-10.)

2-17. CORNERS. The corners at intersections of bulkheads and spars are sealed by installation of formed corner cups and injection of void sealer, EC801, through a fitting located directly at the interior corner. Injection is continued until sealer has been forced from the end of each void channel and the channels secured with aluminum sealing plugs.

2-18. OTHER VOIDS. The following voids are injected with void sealer EC801 and secured with aluminum sealing plugs: Front spar web splices at rib stations 1.5, 3 and 6.5, rear spar web splices at rib stations 4.5, 6.5, and 9.5, spanwise seam of skin splices intersecting bulkhead rails at rib stations 0, 6, and 12. The chordwise void of skin splices over centerline of bulkhead upper and lower rails is prepacked with caulking compound composed of 3 parts of void sealer, EC801, mixed with 5 parts of ground rubber, fairprene No. M5570—proportions are by volume measure.

2-19. FILLETS. A fillet of void sealer EC801 is applied at the following points, covering all fasteners in the areas with approximately 0.062 inch coat:

a. Along both sides of rib station 0, lower rail, from front to rear spar and from the vertical leg of the "T" to approximately 2 inches outboard of the "T."

b. Over and around the wet face of hull to wing attaching daggers, rib station 1, front and rear.

c. Hull attaching dagger, rib station 2, front spar, right side only.

d. Fillet over head of bolts attaching hull fittings at front and rear spars, rib station 2 and outboard, left and right.

e. Over and along chordwise splice plates, lower surface only, outboard from rib station 0 covering all fasteners common to exterior fore and aft splice plates.

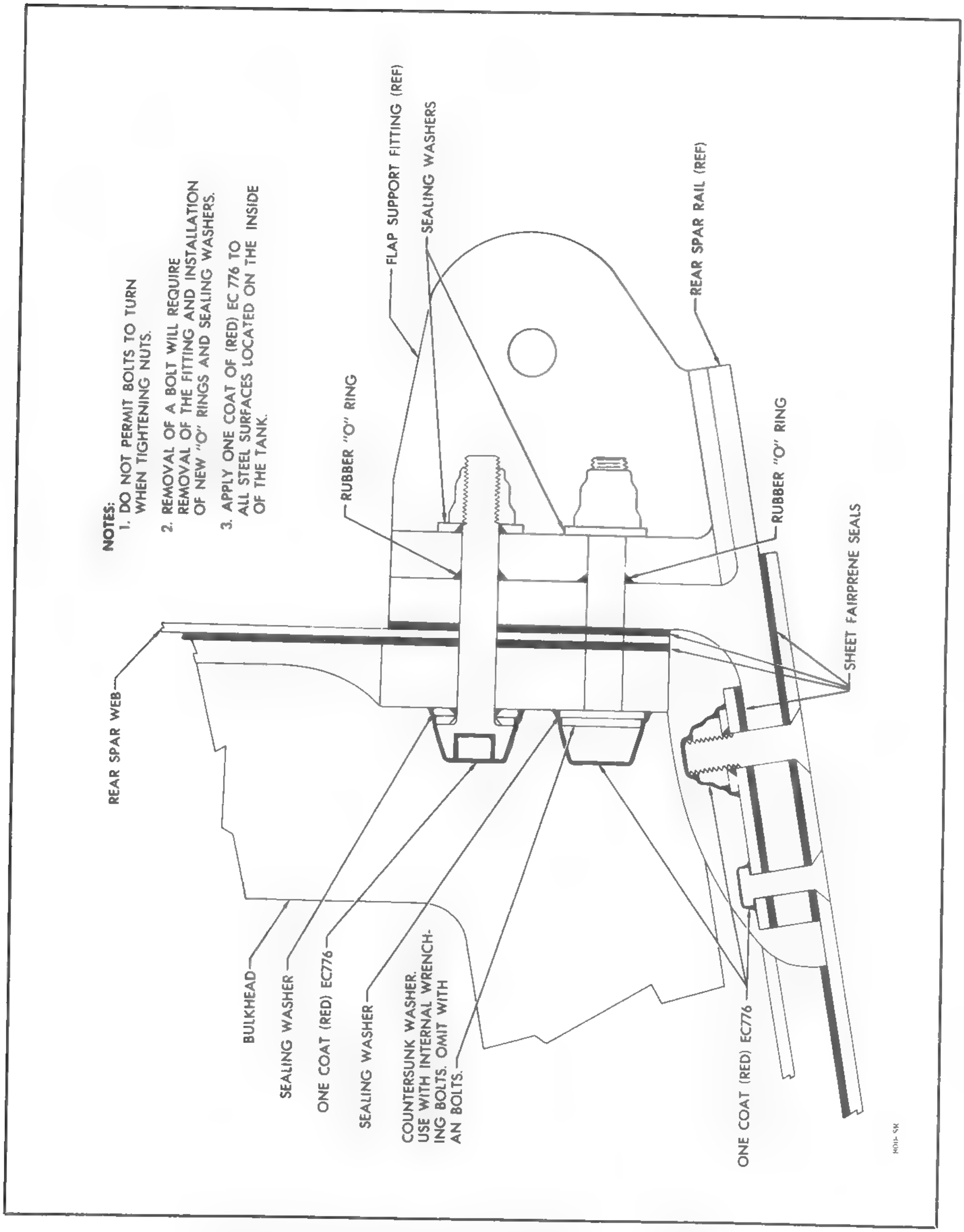


Figure 2-[redacted]. Installation of Fittings and Fasteners in a Fueltight Area

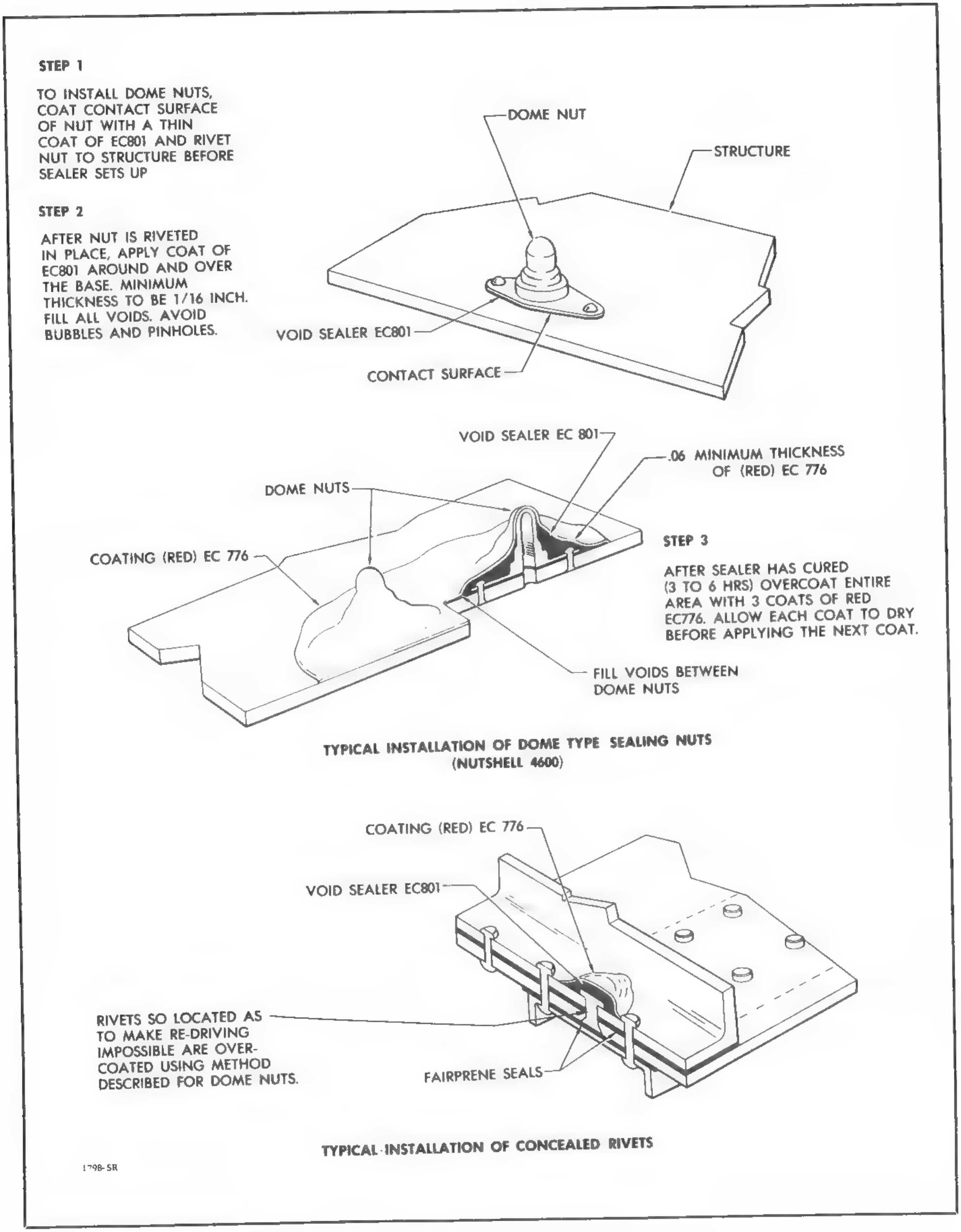


Figure 2-9. Overcoating of Platenuts and Concealed Rivets

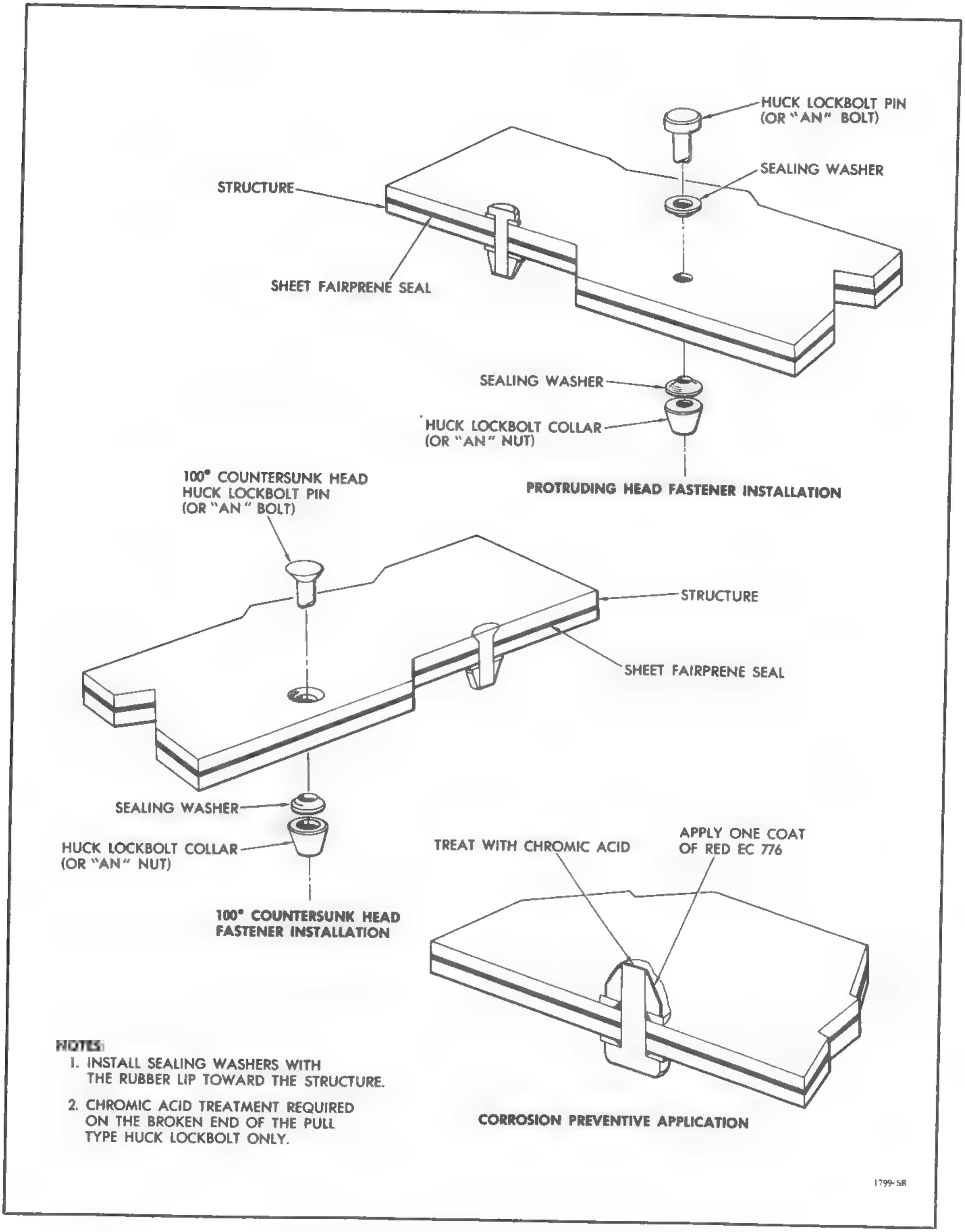


Figure 2-10. Installation of Huck Lockbolts and AN Bolts in Fueltight Areas

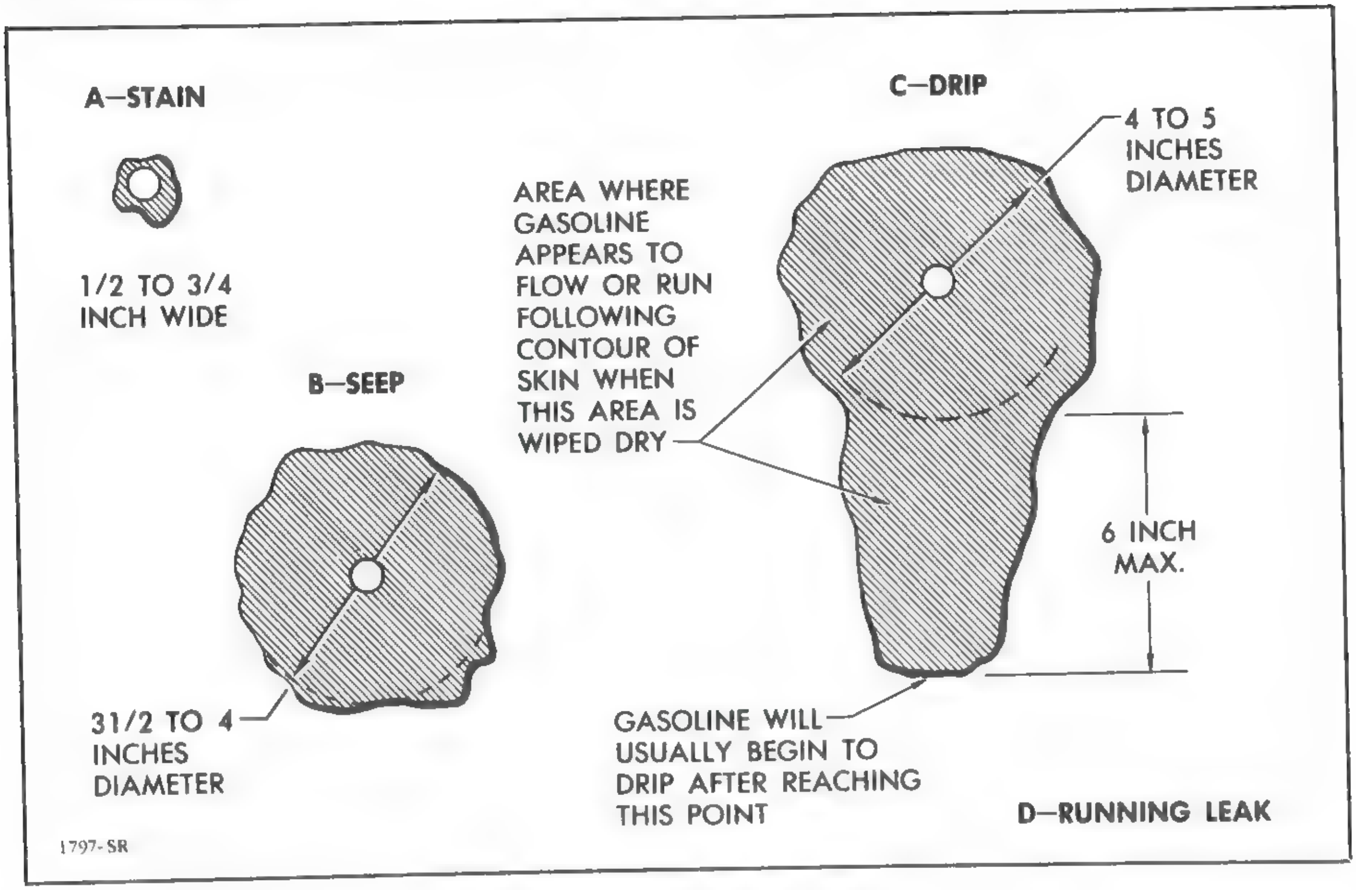


Figure 2-11. Fuel Leak Stain Pattern

f. Around all edges of gas-tight corners rib stations 0, 6, and inboard 12, and all aluminum sealing plugs.

After this filleting has cured, it is given three coats of cement, Type I (EC776 colored with red dye), covering all sealer, and extending approximately 0.75 inch beyond on the bare metal.

2-20. INDICATIONS. (See figure 2-11.) Fuel leaks are usually first indicated by stains which are a deposit of fuel coloring matter after fuel has evaporated. A study of the stain pattern can help in evaluating the importance of a leak. The importance depends on classification and location. Fuel leaks are generally classified as:

Stain:	A dry discolored area.
Seep:	A wet discolored area.
Drip:	Free droplets.
Run:	A continuous stream.

Locations are classified as:

Open:	Wing skin except through nacelle and hull areas.
Ventilated:	Upper surface of wing through nacelle area and front spar surface except through hull.
Closed:	Entire wing lower surface in the hull area, rear spar and bulkhead 6 left and right.

Stain patterns take time to develop. After discovery and initial evaluation, the stain should be removed with Methyl Ethyl Ketone and the area wiped dry. Subsequent inspections should be made to determine the character and value of the leak and the repair method to be employed.

2-21. SMALL DRY STAIN. Not considered dangerous when in open or ventilated areas. Generally need not be repaired until overhaul period. Clean area and watch for development to a different classification.

2-22. LARGE DRY STAIN. Not considered dangerous when in an open area. May indicate that under full fuel load or flight condition it would be classed as a seep or drip. If in a ventilated area, a temporary repair would be permitted. If in a closed area, it should be repaired before flight.

2-23. SEEP. A wet stain. Generally not considered dangerous if in an open area. Temporary repair at least desirable if in a ventilated area. Must be repaired if in a closed area.

2-24. DRIP. A drip must be repaired immediately. A temporary repair would be permitted in an open or ventilated area unless structural damage is suspected. Wipe clean and dry and attempt to locate the source.

2-25. RUN. Runs usually occur only due to improper installation or torquing of parts during maintenance or repair operations or to failure of structural parts due to fatigue or abnormal stress. They must be repaired immediately.

NOTE

It should be remembered that when fuel tanks remain empty for three or more days, the caulking materials and fairprene seals tend to dry out and some leaks may occur. In this case safety precautions should be observed, but evaluation should not be completed until the tanks have been full of fuel for 24 to 36 hours. This condition will usually correct itself and repairs will not be necessary.

2-26. TEMPORARY REPAIRS. Temporary measures can often be taken to stop leaks or reduce them to a safe level until a permanent repair can be made or until a regular overhaul period. These measures should only be taken after inspection has determined that the leak is not caused by a failure which renders the structure unsafe.

NOTE

Temporary repairs should not be attempted in closed areas.

2-27. REPAIR. Stains, seeps, and drips occurring at rivets may be sealed or retarded temporarily by overcoating with sealer, EC801. All paint and prime must be removed from the rivet and surrounding metal using stripper, Navy Specification 52R15. Reduce fuel level if necessary, so the area will be dry. Avoid contact with hands after cleaning as the metal must be free of all foreign matter and oils to insure adhesion. Paint a heavy coat of sealer, EC801, over an area at least one inch radius from the center of the rivet. If the fuel level cannot be lowered so the area will be dry, as on the lower surface of the wing, proceed as follows: Remove paint and clean area. Tap rivet lightly using a round wooden or plastic peg and a very light hammer or tool, attempting to seat the countersunk head and stop or retard the leak temporarily. Clean the fingers and area thoroughly to remove all oils. Wipe dry with a clean cloth and apply sealer, EC801, to the rivet, attempting to force it into the joint between the rivet and skin. Continue rubbing with a circular motion and deposit a heavy coat over the rivet and surrounding metal. When the leak has been stopped and the coat is satisfactory, permit to set. Paint or prime may be applied over the repair if desired.

NOTE

Keep temporary repairs under close observation to detect recurrence.

2-28. FIELD REPAIRS.

2-29. SAFETY PRECAUTIONS. Remember that practically all sealants used in gas-tighting are toxic and flammable.

a. Keep tank well ventilated and grounded. The fumes are heavy and settle in low, dead areas. Air movers should be set to pick up fumes at the bottom of the tank.

b. All lighting equipment should be approved explosion proof type, in good condition.

c. Air tools should be used in lieu of electric equipment.

d. Avoid accumulation of soiled cleaning rags in the tank.

e. Never work alone in a tank. Maintain constant communication with someone outside.

f. Guard against damaging the interior with sharp tools.

g. Wear clean cotton moccasins when inside the tank to prevent depositing foreign matter and scoring the structure.

2-30. FLANGED OPENING LEAKS. The following items are attached to the skin of the fuel tank area with bolts. Dome type plate nuts are installed internally. A fillet of sealer, EC801, is applied, covering the base of the plate nuts, and coated with cement, EC776, after curing.

Vent lines:	2 in rib station 12, left and right.
Fuel outlet lines:	1 each tank in front spar web, rib stations 2.5 and 7.5, left and right.
Fuel inlet lines:	1 each tank in front spar web, rib stations 4.5 and 7.5, left and right.
Booster pumps:	1 each tank in wing lower surface, rib stations 0.5 and 6.5, left and right.
Access doors:	2 each tank in wing upper surface, rib stations 1.5, 4.5, 7.5 and 10.5.

2-31. REPAIR. If leaks occur at these flanges the following steps should be taken:

a. Check for correct torque of bolts.

b. Remove bolt or bolts nearest leak. Check for poor threads or foreign matter in plate nut and indication of the bolt bottoming. Install new sealing washer and bolt of correct length. Sealer, EC801, may be applied to the countersunk heads of access door screws in lieu of sealing washers.

c. If leak persists, reduce fuel level to clear the opening. Remove unit and gasket. Check for loose or damaged plate nuts or flaws in the sealer, EC801, fillet. To install a new gasket, clean area thoroughly with Methyl Ethyl Ketone. Insure hands are clean and dry. Apply a light over-all film of cement, EC776, to both the metal surface and gasket. Permit to set until tacky before placing the gasket on the metal. The cement is only to assist in assembly and should not be used on the second faying surface. If the internal filleting is bad or plate nuts must be replaced, the tank must be drained and purged: refer to paragraphs 2-32 and 2-33. Defective filleting material should be removed with plastic or micarta scrapers. Do not use metal scrapers as the structure may be marred. Clean thoroughly with Methyl Ethyl

Ketone and wipe with a clean, dry cloth. Apply a new fillet of sealer, EC801, being careful to cover the entire area at the base of the plate nut. After it has set, apply 3 coats of red cement, EC776, covering the entire fillet and extending 0.75 inch beyond the edges. (See figure 2-9.)

2-32. DRAINING. Transfer fuel to another tank using the booster pump. When all the fuel is transferred, remove the booster pump sump drain plug to drain. This will be only one or two gallons and will be all which can be removed by drainage.

2-33. PURGING. Remove both access doors of the tank being purged. Remaining fuel should be soaked up with clean rags and surfaces wiped dry. Fumes are removed by air circulation. Install a venturi type air mover over one opening and leave the other unobstructed. Continue purging operation until negative readings are obtained on a combustible gas indicator in all parts of the tank. It is well to continue this operation while work is being done in the tank to provide ventilation, remove fumes of sealants which are also explosive, and prevent recontamination of the air.

2-34. LEAKS AT RIVETS. Leaks may develop at rivets during service. Corrosion resistant steel rivets may be re-hit to attempt a fix, but replacement is usually more satisfactory. DD rivets and Huck lockbolts must be replaced.

2-35. REMOVAL OF FASTENERS. Fasteners must be removed carefully to avoid damage to the hole. Remove aluminum rivets by drilling from the manufactured head slightly beyond the depth of the head using a drill 0.030 inch under the rivet shank diameter. The drill used for removing corrosion resistant rivets should only be 0.002 to 0.004 inch under the rivet shank diameter and must be in very good condition. Extra care must be used in centering on the rivet so the head will be almost completely severed without damage to the structure. Punch out the rivet using a pin punch slightly smaller than the drill. Back up the structure with a hardwood or micarta block to prevent damage. (See figure 1-22, Section I, for removal of Huck lockbolts.)

2-36. REPLACING ALUMINUM RIVETS. Check hole for condition and fit of the rivet shank. For flush rivets, check countersink for being concentric, smooth, and correct depth. The rivet head should protrude slightly when firmly seated. Swab the head and upper shank of the rivet with sealer, EC801, and drive rivet. If the hole is oversize, it should be trued up and a special rivet machined to fit the hole. (The next larger rivet should not be installed without engineering approval.) This should be done only when absolutely necessary and with care as generally only one oversizing is permitted. If a countersink is deformed, eccentric, or too deep, a round head rivet (AN430) may be inserted from the inside and the countersink filled by swaging the rivet shank into it. The rivet should be drawn, using a flush draw set, to seat it before riveting. Use care to have the flush rivet set straight on the rivet and start riveting with light blows to insure swelling and filling the bottom of the countersink. Increase the intensity of the blows and rock the gun with a circular motion to pack the rivet into the countersink. Trim off the head as needed to produce the finished head. Use care in installing replacement rivets as faulty bucking or overdriving may cause adjacent rivets to leak.

2-37. CORROSION RESISTANT STEEL RIVETS. Rules for aluminum rivet replacement, in general, apply for corrosion resistant steel rivets. Less swelling of the shank occurs, making hole size more important. Due to the heavy blows required to correctly head these rivets, it is advisable to re-hit one or two adjoining rivets on each side of the replaced rivet or pattern, using a reduced pressure.

2-38. HUCK LOCKBOLTS. Leaking Huck lockbolts should be replaced, using all new parts. (See figure 1-22.) Swab the head and upper shank of the countersunk head type with sealer, EC801, before installing. Treat the raw steel at the break of the pull type with chromic acid. Apply one coat of red cement, EC776, to the stump and collar of either type if located on the inside of the tank.

2-39. SEAM OR PATTERN. When installing a number of rivets in a seam or pattern, the area should be clamped, using bolts in every fifth or sixth hole. The bolts should be removed and rivets installed after the remainder of the pattern is driven.

2-40. FILLETS. Leaks at corners may originate at a faulty fillet. It should be checked for loosening and possible pinholes. Suspicious filleting should be replaced.

2-41. REMOVAL AND PREPARATION. Use micarta or plastic scrapers to remove the old fillet material as thoroughly as possible. Do not use a stripping agent to wash the metal clean. Wipe with Methyl Ethyl Ketone and dry with clean cloths. Any oil, particularly the oil from human hands, will prevent the bonding of sealer and cement (EC801 and EC776) to the metal surface. If a fillet is not completely replaced, the remaining ends should be tapered to permit a one-inch lap of new sealer over the old fillet.

2-42. APPLICATION. Sealer EC801 must be applied during the active working life of the material (see Appendix I). The fillet should cover every part of the seam to a depth of 0.062 inch minimum and extend 0.75 inch on each side. It may be applied with a gun, plastic spatula or brush. Insure complete filling of corners and elimination of trapped air and pin holes. Do not attempt to rework after the sealer has started to set. However, additional sealer may be applied to touch up weak points.

2-43. TEMPERATURE. The structure or air temperature should not be less than 21.1°C (70°F) or more than 51.7°C (125°F). Higher temperatures accelerate the curing and improve the adhesive properties of the sealant. However, the fumes of cement coating, EC776, are highly flammable and any heating device must be completely explosion proof.

2-44. COATING. Three separate coats of colored cement, EC776, shall be applied after the sealer, EC801, has set enough not to be disturbed by brushing on the coating. Cover all new sealer and lap at least 0.75 inch at any point and beyond edges of the fillet.

2-45. OVERCOATING. If leaks cannot be repaired by other methods, it may be necessary to overcoat the suspected area with sealer, EC801, to a depth of at least 0.062 inch over all fasteners and seams. Apply carefully to avoid bubbles and pinholes. Apply three coats of red cement, EC776, after sealer has set. This should be classed as a temporary repair and the corner or splice should be removed, cleaned, reinstalled, and injected at the next overhaul period.

NOTE

No attempt should be made to re-inject sealer, EC801, at corners and seams.

2-46. TIGHTNESS TEST. The tank may be tested for leaks by pressurizing with air and applying Kelite bubble fluid No. 26 to the points to be tested.

a. Plug the vent line located on the lower surface of the wing between rib stations 14 and 16. Close tank valve and refueling valve. Install one access door. Install a dummy door which incorporates a safety blow-off valve set to relieve pressure in excess of 3.5 psi, and an air inlet fitting, on the other access opening.

b. Connect an air line to the tank area through the inlet, using a standard air test mercury monometer board for pressure control. Maximum test pressure to be 3.5 psi.

c. Inspect for leaks by applying Kelite bubble fluid to seams and rivets to be tested. A leak will be indicated by bubbles and froth. A larger leak may blow through and produce no bubbles except immediately as the fluid is being applied. Mark leaks for rework. All Kelite shall be removed after testing is completed.

d. Remove plug from the vent line. It should be equipped with a pennant to insure removal.

2-47. BLOW BACK METHOD. When the origin of a leak cannot be found by inspection, the blow back method may be effective. With the tank drained, purged, and well ventilated, apply shop air pressure to the external leak point using a length of hose as the nozzle. Check for the internal leak point using Kelite bubble fluid. This should be applied very sparingly and cleaned up thoroughly with clean, dry rags after the test. Leaks may originate at some distance from the external indications.

NOTE

Due to the drying of fairprene strips and gaskets, testing should be accomplished as soon as possible after drainage and purging.

2-48. MAJOR REPAIRS. Repair of damaged structure and leaks at corners are very complex and will not be illustrated in this manual at this time. Individual engineering action will be required in most cases involving structural repair, and fuel-tighting must be tailored to fit the need. Manufacturing practices should be followed whenever possible.

2-49. LEADING EDGE. (See figure 2-12.)

2-50. GENERAL. The leading edge as referred to in this handbook is that portion of the structure located forward of the front spar. This component is constructed of corrosion resistant steel throughout, with the exception of the aft baffle. It serves three purposes, all of which must be considered in evaluating damage and designing repairs. They are as follows:

a. *Aerodynamic.* Aerodynamically, the shape and smoothness of the leading edge is more important than that of any other part of the wing. A distorted or rough leading edge will seriously affect the flight characteristics of the airplane.

b. *Anti-Icing.* Hot exhaust gases are circulated through the leading edge to effect anti-icing. The interior construction of the leading edge assembly is designed to control this circulation and obtain uniform heating. A corrugated inner skin is attached to the outer skin, thereby producing channels. The interior of the leading edge is divided by the forward baffle into two ducts; the forward will be identified as the "D" duct and the aft as the exhaust duct. The aft baffle is the aft wall of the exhaust duct and insulates the interspar structure. A smooth liner is located in the forward part of the "D" duct. Hot air under pressure is introduced into the "D" duct outboard of the outboard nacelle and distributed by it to the full length of the wing. Hot air under pressure enters the channels between the corrugated liner and smooth outer skin through holes located in the most forward part of the "D" duct. It is bled off to the exhaust duct through smaller metering holes located at the aft end of each channel. The exhaust duct is vented at numerous points and the pressure within it will be approximately outside air pressure. Consequently a hole in the skin in the area of the "D" duct would rob the system of heating air. A hole in the skin in the exhaust duct area would do the same but to a lesser degree as escaping air would be metered through the intake holes in the forward end of the corrugations. Torn inner lining in the exhaust duct area would have the same effect on the system. A hole in the forward baffle would allow hot air to pass directly to the exhaust duct and reduce the system pressure. A hole in the aft baffle would not affect the anti-icing but would heat the interspar structure and constitute a hazard. Any repairs to the leading edge must consider these functions.

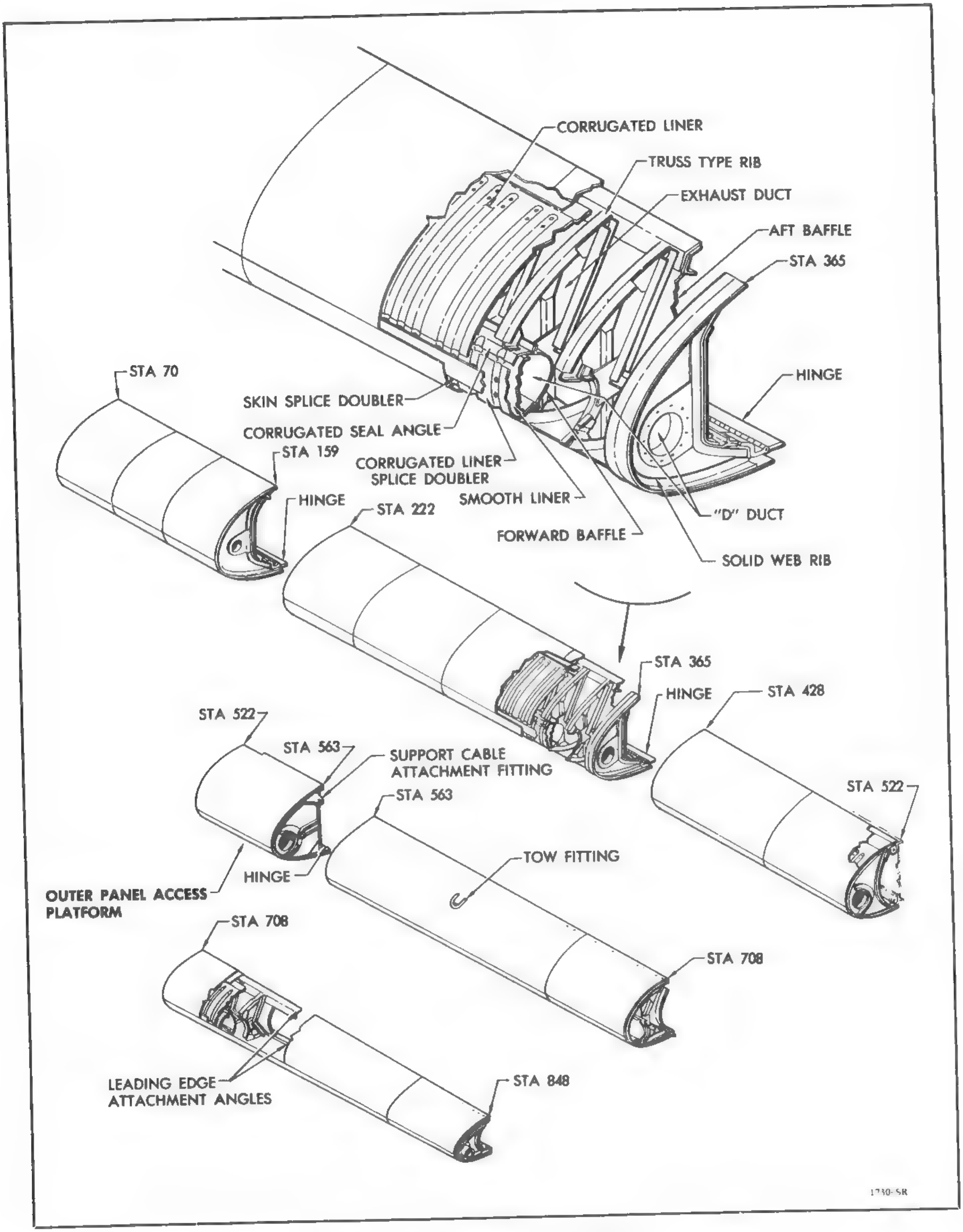


Figure 2-12. Wing Leading Edge Structure

c. *Fairing.* The leading edge serves as a cover for fuel lines, valves, controls, and wiring which are located on or routed along the front spar. For ease of access, the sections between the hull and inboard nacelle and between nacelles are hinged. A section at the inboard end of the outer panel is also hinged and serves as a platform for entry to the wing interior by way of an access door in the front spar web. The remainder of the leading edge is attached by countersunk head machine screws and gang channel nuts and is removable.

2-51. CONSTRUCTION. The leading edge structure consists of spanwise attachment angles and truss type ribs. Ribs are fabricated of formed angle, channel, and zee members spot welded together and reinforced by gussets. The skin consists of a smooth outer skin and corrugated liner which are pre-formed and spot welded together. (For arrangement of the various elements, see figure 2-12.) Spot welding is used throughout the structure, with corrosion resistant steel rivets used only to facilitate assembly.

2-52. NEGLIGIBLE DAMAGE. Damage must be evaluated from a functional viewpoint. Dents which are accepted as being negligible aerodynamically and do not destroy the seal between "D" duct and exhaust duct may be classed as negligible. Nicks and scratches are unlikely due to the light gage and hard surface of the parts. Holes or cracks are not allowed in any parts. Buckling of the aft baffle is negligible if the seal is not destroyed.

2-53. DAMAGE REPAIRABLE BY PATCHING. (See figures B-10 through B-12, Appendix II, for examples of this type of repair to skin and forward baffle.) Holes in the aft baffle may be repaired by patching, using a corrosion resistant steel patch of 0.016 gage and 0.093-inch corrosion resistant steel rivets. Sealing action is the only requirement.

2-54. DAMAGE REPAIRABLE BY INSERTION. Engineering action is required for damage of this magnitude. Sections of the aft baffle may be inserted with the seam being reinforced.

2-55. DAMAGE NECESSITATING THE REPLACEMENT OF PARTS. Cracked spotwelds may be replaced with corrosion resistant steel rivets. Damaged rib members may be replaced. (See table I-XI for diameter of rivets, and figure B-13, Appendix II, for a typical repair.) The aft baffle may be replaced if damaged beyond repair. It will probably be desirable to replace an entire section of leading edge if damaged very seriously as repairs of a permanent nature will be quite complicated and costly.

2-56. TRAILING EDGE. (See figure 2-13.)

2-57. GENERAL. The trailing edge, as referred to in this handbook, is that section of the wing structure located aft of the rear spar, excepting flaps and controls. This section, in general, serves as a fairing between the interspar structure and the flaps and ailerons. It also serves as a housing for various items of auxiliary equipment, ducts and controls. It is riveted and bolted permanently to the rear spar of the interspar structure, with the exception of removable sections located outboard of each engine nacelle. 75ST aluminum alloy is used throughout.

2-58. CONSTRUCTION. The structure consists of ribs, formers, skin and baffle. Integrated in this structure are reinforced ribs or brackets which support the flap and aileron hinges. Between the hull and inboard nacelle, an auxiliary spar is supported by heavier ribs and it in turn supports a series of smaller ribs. Ribs and formers are hydropressed stampings with flanges, beaded lightning holes, and cutouts. Skin and baffle are of light gage and are relatively lightly stressed. They are dimpled and attached with 100° countersunk rivets. The flap and aileron support brackets are heavy members built up of sheet stock and extrusions. They are attached directly to the rear spar by high strength, internal wrenching bolts and nuts. (See figure 2-13 for an installation detail.)

2-59. NEGLIGIBLE DAMAGE. (Refer to paragraph 1-38.) This section of the wing is the least stressed and more damage may be permitted. With the exception of flap and aileron support brackets, auxiliary spar support ribs and internal members supporting items of equipment, damage which does not interfere with the operation of any control will not interfere with flight. Fatigue cracks in skin or formed ribs may be stop drilled, routed out, smoothed, and patched. Holes in skin should be repaired for appearance and weathertightness, though not structurally dangerous. Flap and aileron support brackets are primary structure and only minor dents, scratches, or nicks may be permitted.

2-60. DAMAGE REPAIRABLE BY PATCHING. Repair principles outlined in Section I and illustrated in Appendix II are applicable in this area.

2-61. DAMAGE REPAIRABLE BY INSERTION. Repair principles outlined in Section I are applicable in this area.

2-62. DAMAGE NECESSITATING REPLACEMENT OF PARTS. Fittings should be replaced if damaged beyond negligible limits.

2-63. WING TIP. (See figure 2-14.)

2-64. GENERAL. The tip is a miniature wing panel attached to the outboard end of the outer panel by machine screws and bolts. It consists of interspar structure, leading edge, forward tip cone and aft tip cone. These four parts are connected by machine screws and are removable.

2-65. The interspar structure consists of two spars, bulkheads and stringers. It is relatively lightly stressed and values of negligible damage and repair are the same as those for trailing edge. The leading edge can be considered part of the wing leading edge. The forward tip cone is fabricated of corrosion resistant steel, the for-

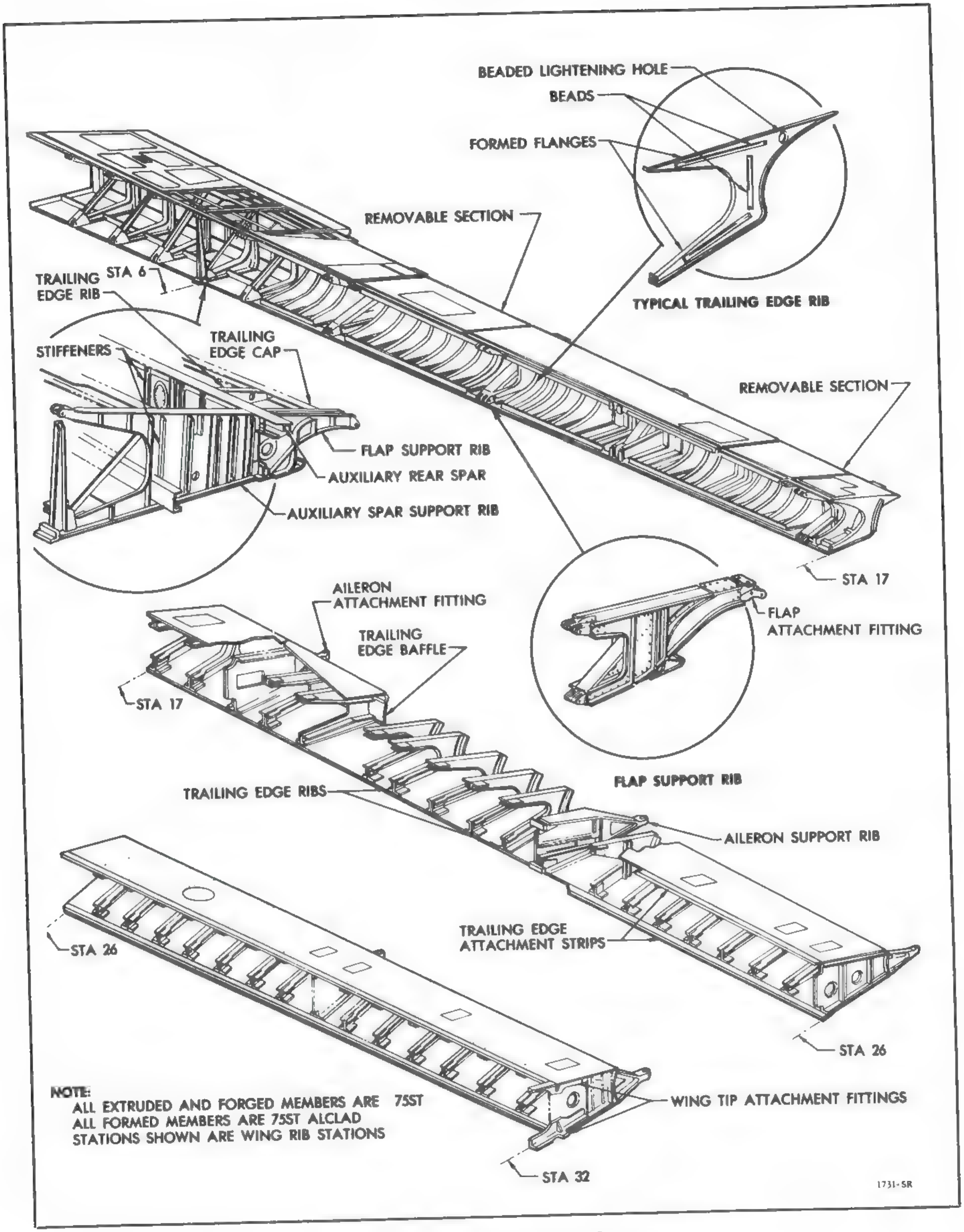


Figure 2-13. Wing Trailing Edge Structure

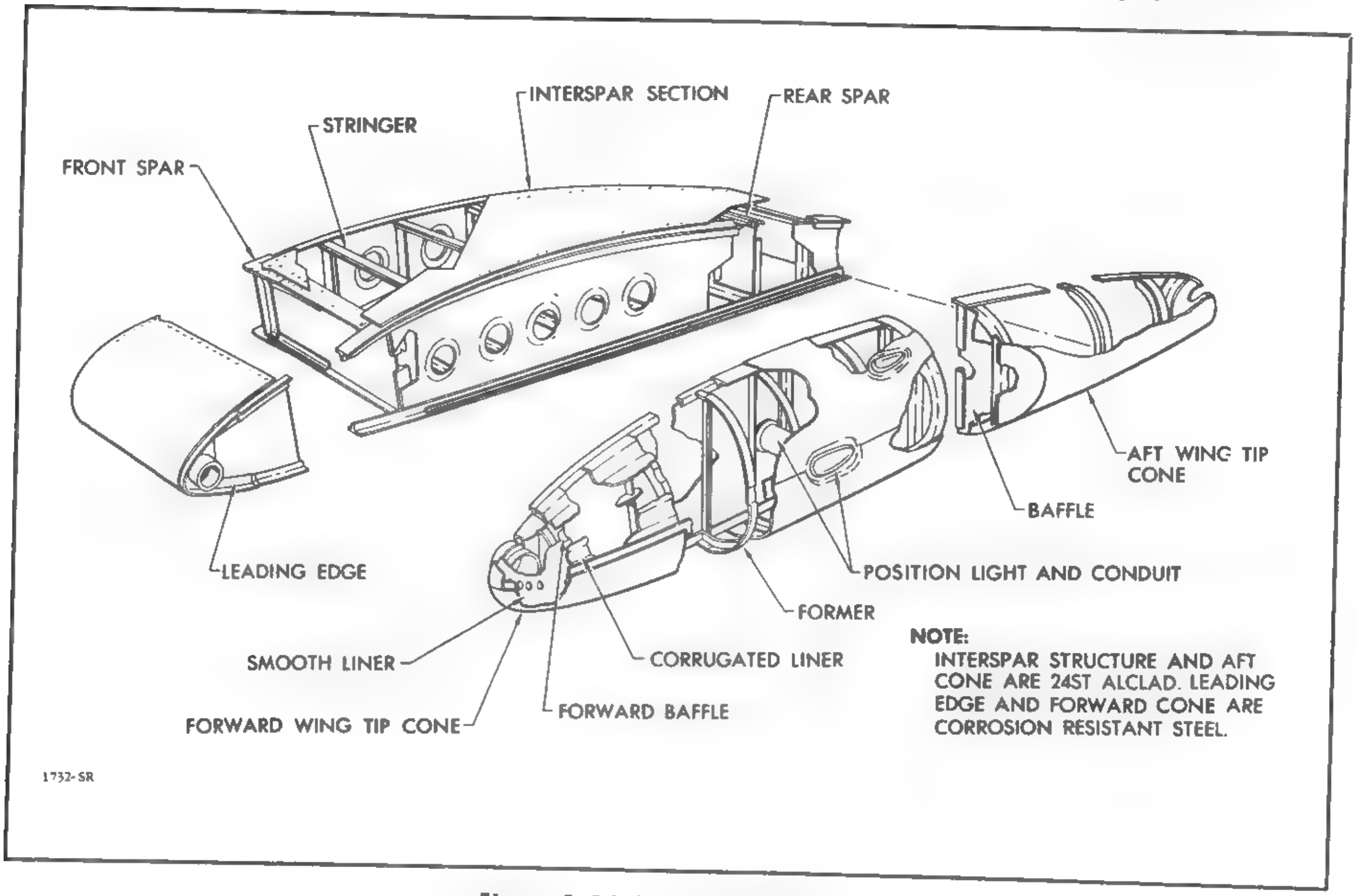


Figure 2-14. Wing Tip Structure

ward portion being an anti-icing element and the rear portion an exhaust duct and vent. It can also be considered to be part of the leading edge. The rear tip cone consists of formers and skin of aluminum alloy and can be considered part of the trailing edge.

2-66. WING FLAPS. (See figure 2-15.)

2-67. GENERAL. The wing flaps are located aft of the trailing edge section and extend from the hull to the outer panel at rib station 17. They are divided into three units on each side of the hull and are identified as inboard, intermediate, and outboard flaps. Each flap is supported by two brackets which are described in the trailing edge section. It is attached by a forward and aft link arm at each support bracket.

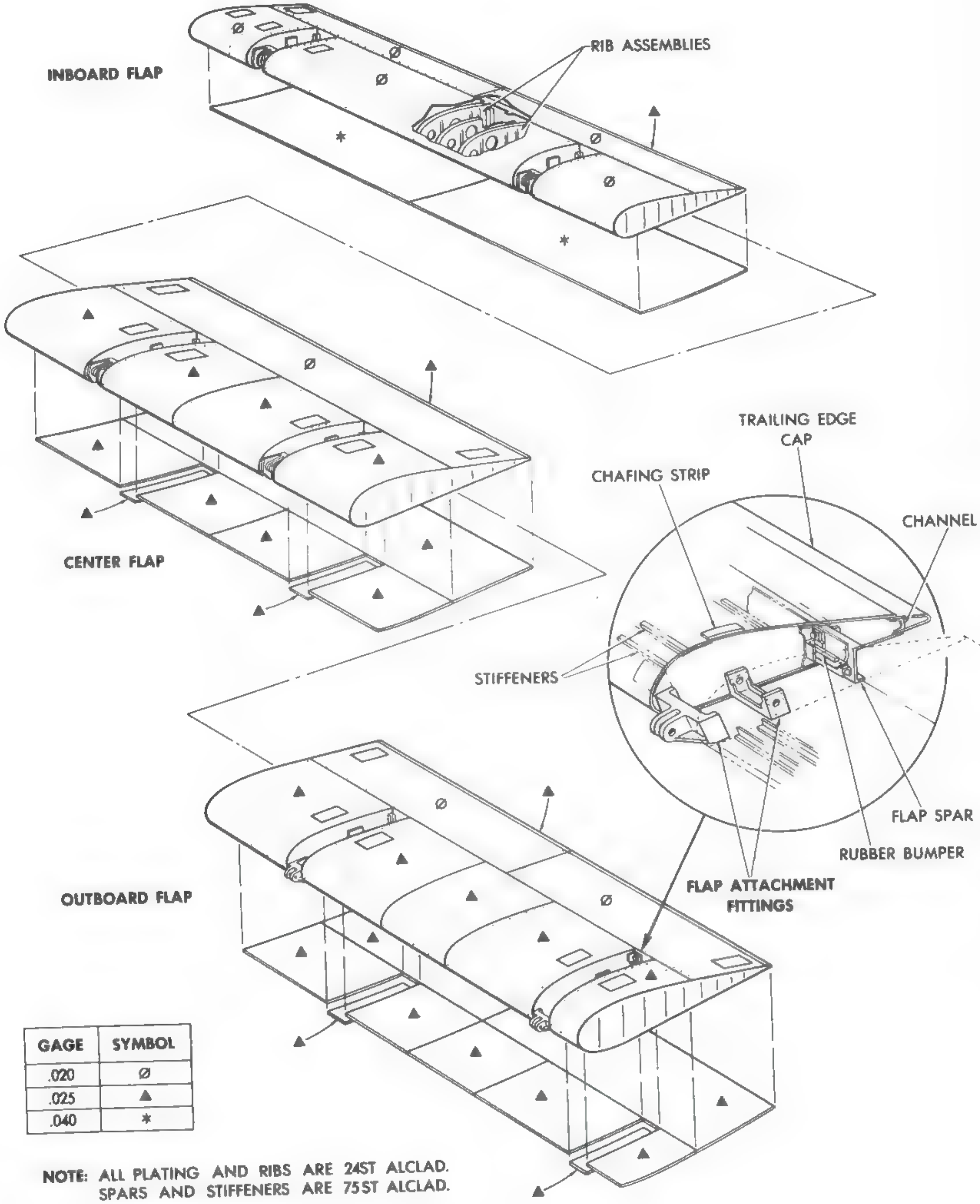
2-68. CONSTRUCTION. The flap structure consists of main spar, leading and trailing edge ribs, trailing edge spar, trailing edge cap, and skin. The main spar consists of a sheet stock web with formed angle rails. The trailing edge spar is a roll formed channel. The ribs are hydropress flanged and beaded stampings with flanged lightning holes. Spars and ribs adjacent to the attachment fittings are 75ST alclad. Other ribs, skin and trailing edge cap are 24ST alclad. Rib flanges and skin are dimpled and flush riveted throughout.

2-69. NEGLIGIBLE DAMAGE. (Refer to paragraph 1-38.) Ribs, skin, and spar adjacent to the attachment fittings are highly stressed and negligible damage will be limited to minor dents, nicks, and scratches. Fatigue cracks in this area must be repaired. Moderate dents, scratches, and small holes in skin at other points and at the trailing edge cap may be classed as negligible. Fatigue cracks in the same area may be stop drilled pending repair.

2-70. DAMAGE REPAIRABLE BY PATCHING. Repair principles outlined in Section I and illustrated in Appendix II are applicable to flap repair. When possible, skin patches should be flush with dimpled skin and countersunk head rivets. When necessary, cherry blind rivets may be used, except in areas adjacent to the attachment fittings.

2-71. DAMAGE REPAIRABLE BY INSERTION. Repair principles outlined in Section I are applicable in this area.

2-72. DAMAGE NECESSITATING REPLACEMENT OF PARTS. Attachment fittings and link arms must be replaced if damaged beyond the limits of negligible damage. The entire flap may be replaced if damaged beyond the point of economical repair.



GAGE	SYMBOL
.020	Ø
.025	▲
.040	*

NOTE: ALL PLATING AND RIBS ARE 24ST ALCLAD.
SPARS AND STIFFENERS ARE 75ST ALCLAD.

Figure 2-15. Wing Flap Structure and Plating

2-73. AILERON AND TABS. (See figure 2-16.)

2-74. GENERAL. The aileron extends the full length of the outer panel and is equipped with a flight tab and trim tab. The aileron must be in static balance with tabs installed. The flight (control) tab must be in static balance in itself. Counterweights are located in the leading edges of these units for this purpose. (Refer to paragraph 1-81 and see figure 1-27 for balancing information.) The trim tab is not statically balanced. The aileron and tabs are each subjected to torsion loads which are carried primarily by the skins, and are heaviest at points of applied forces, as at actuating control attachment points.

2-75. CONSTRUCTION

2-76. AILERON. The structure of the aileron consists of a main spar, rear spars, nose and trailing edge ribs, bead strips and stressed skin. The main spar is built up with an alclad sheet web and formed angle rails. The rear spar is in three sections. At the flight tab cut-out, it is built up of a curved web and formed angle rails. At the trim tab cut-out and the trailing edge cap it is a channel formed from sheet alclad. Ribs are hydropress stampings with integral flanges and beaded lightning holes. Bead strips are spanwise stiffeners of beaded alclad strips (hat sections). Skin and ribs are dimpled and flush riveted. 24ST aluminum alloy is used throughout the aileron.

2-77. FLIGHT (CONTROL) TAB. The structure of the control tab consists of a formed channel spar, stamped flanged ribs and skin. Skin and ribs are dimpled and flush riveted. The spar is 75ST alclad—all other parts are fabricated from 24ST alclad.

2-78. TRIM TAB. The structure of the trim tab is similar to that of the flight tab. It is not statically balanced and the leading edge is open. 24ST alclad is used throughout.

2-79. NEGLIGIBLE DAMAGE. The ailerons and their tabs are not highly stressed except in the vicinity of actuating control attachments and hinges. They are very important from an aerodynamic viewpoint, however, and dents or distortion of the trailing edges are not allowed. Scratches, nicks, and small holes are permissible but are more important adjacent to hinge and actuating control attachment points. Fatigue cracks may be stop drilled except in these areas, where they should be repaired immediately.

2-80. DAMAGE REPAIRABLE BY PATCHING. Repair principles outlined in Section I and illustrated in Appendix II are applicable to ailerons and tabs. All skin repairs should be flush, dimpled and flush riveted. Repair to the trailing edge cap of the aileron may be external as shown in figure B-10. It should be symmetrical on upper and lower surfaces. Engineering approval will be required before applying other external patches and protruding or blind rivets.

2-81. DAMAGE REPAIRABLE BY INSERTION. Repair principles outlined in Section I are applicable to ailerons and tabs.

2-82. DAMAGE NECESSITATING THE REPLACEMENT OF PARTS. Attachment fittings and actuating linkage must be replaced if damaged beyond negligible limits. Steel bushings in fittings may be replaced. They should be a tight dress fit and be installed coated with wet primer. If tabs are damaged seriously, replacement of skin or entire tab may be more economical than repair.

NOTE

> Any repair, refinish or replacement of tabs or aileron will require check of static balance (Refer to paragraph 1-81 and see figure 1-27.)

2-83. AUXILIARY FLOAT ASSEMBLY. (See figures 2-17 and 2-18.)

2-84. GENERAL. The auxiliary float assembly consists of a float, two identical side struts and a center strut on each wing. The attachment to the wing outer panel interspar structure is at rib station 22 on the front wing spar and rib stations 19 and 25 on the rear spar.

2-85. AUXILIARY FLOAT.

2-86. GENERAL. The auxiliary float is of watertight construction throughout. The interior is divided into three watertight compartments. Access to each compartment is through an access door on the left side of the float. A mooring ring is provided on the inboard side and aft end of each float. Right and left floats are identical except for location of the side mooring ring, however, attachment provisions are made on each side.

2-87. CONSTRUCTION. The auxiliary float is of semi-monocoque construction and consists of watertight bulkheads, frames, and stressed skin with external keel and chine angles. An external longeron is attached to the top center of the float. Watertight bulkheads are heavily reinforced and are equipped with strut attachment fittings. The frames are stamped channel members, reinforced from chine to keel. The skin is attached to the structure with universal head rivets. Seams are lap type and all faying surfaces at seams, chine, keel and watertight bulkheads are sealed by zinc chromate tape. 75ST alclad is used throughout the structure and skin except for formed nose and tail skin. (See figure 2-19.)

2-88. NEGLIGIBLE DAMAGE. (Refer to paragraph 1-38.) Dents, scratches and nicks are permitted. Fatigue cracks and holes must be repaired. Dents at seams, chine, or keel may be permitted if watertightness is not affected.

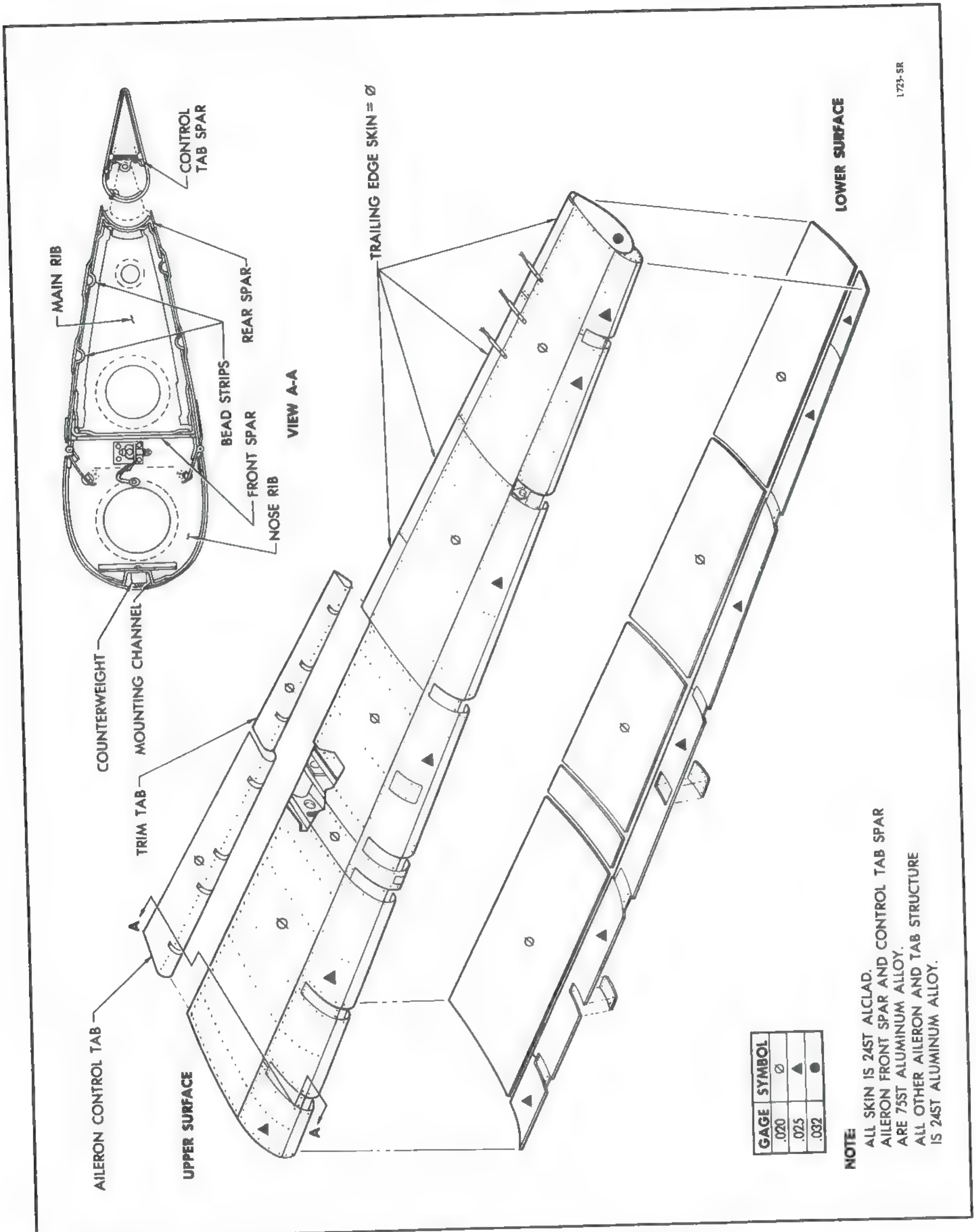


Figure 2-16. Aileron and Tab Structure and Plating

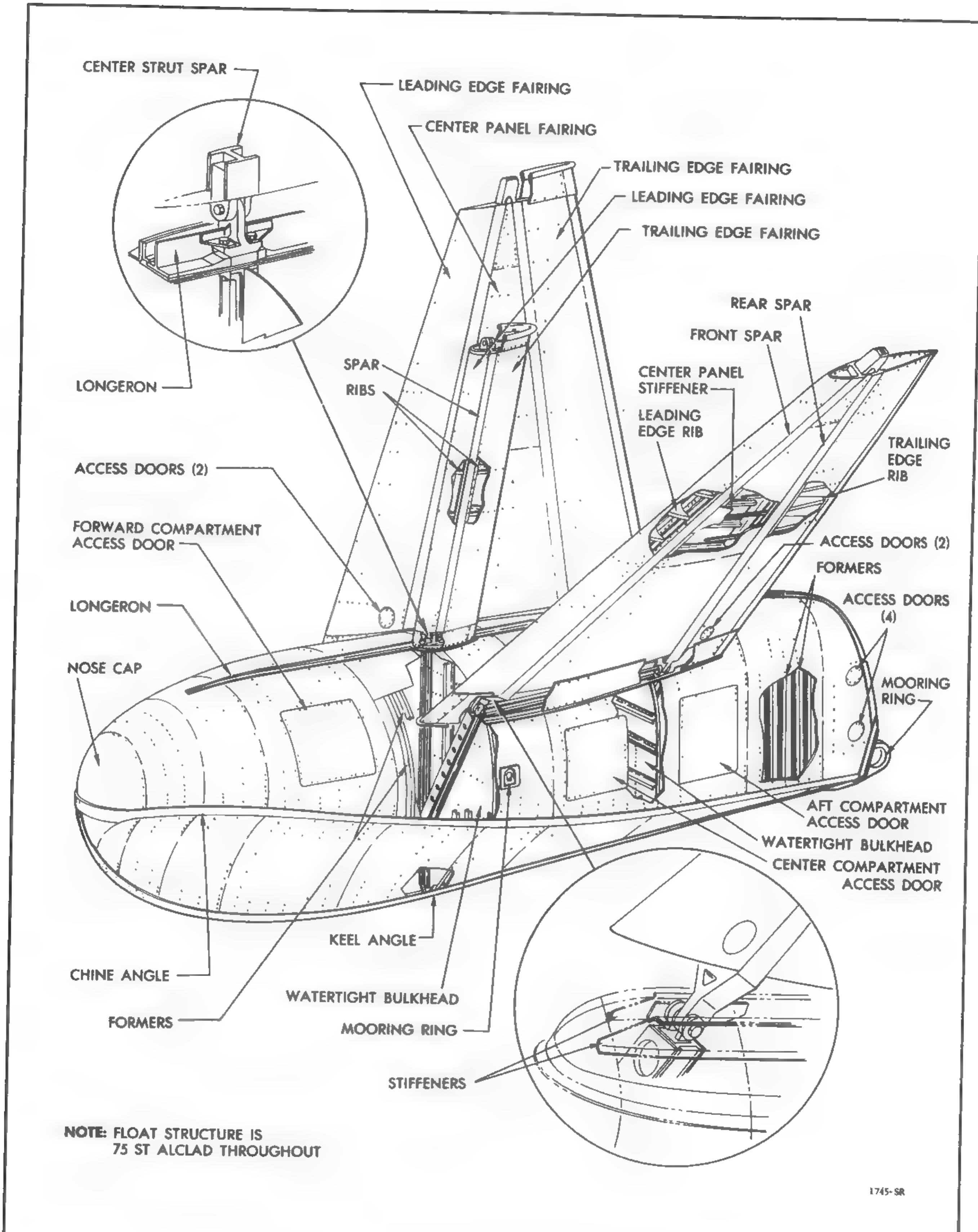


Figure 2-17. Auxiliary Float and Strut Structure

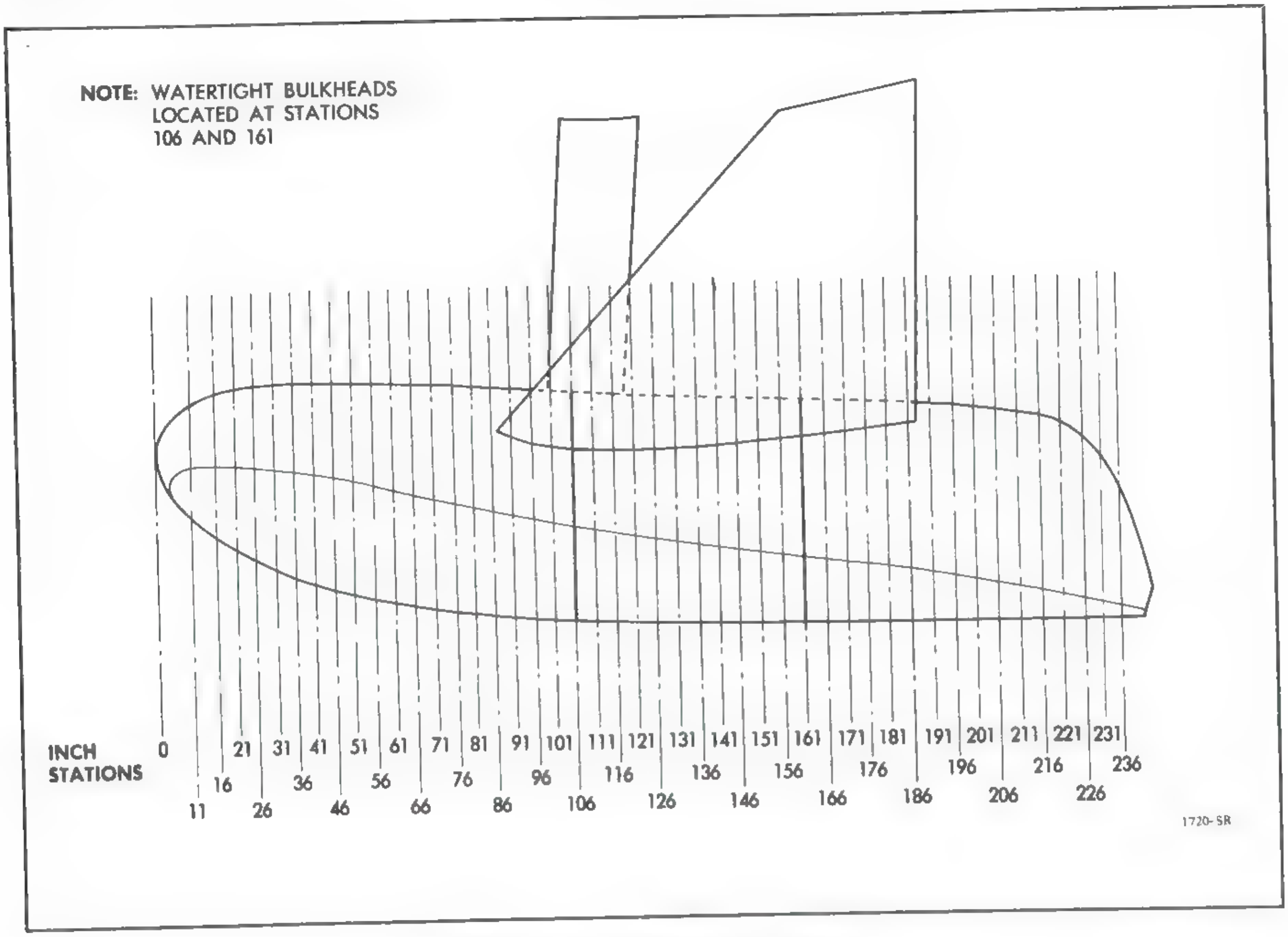


Figure 2-18. Auxiliary Float Stations

2-89. DAMAGE REPAIRABLE BY PATCHING. Repair principles outlined in Section I and illustrated in Appendix II are applicable. Zinc chromate tape must be installed between faying surfaces of skin or bulkhead patches. External patches with protruding head rivets are recommended. Repairs to bulkhead or longeron at strut attachment fittings will require engineering approval.

2-90. DAMAGE REPAIRABLE BY INSERTION. Repair principles outlined in Section I are applicable.

2-91. DAMAGE NECESSITATING REPLACEMENT OF PARTS. Strut fittings which are damaged beyond negligible limits must be replaced. Access doors and side mooring ring are readily replaceable.

2-92. FLOAT ATTACHMENT STRUTS.

2-93. SIDE STRUTS. Two side struts are employed in attaching each float. They are identical and interchangeable. Each consists of a front and rear spar attached to a common fitting at the upper end. Each lower spar end is equipped with a fitting for attachment to the float at bulkhead stations. The spars consist of a sheet stock web, machined extruded "T" rails, and formed angle stiffeners. A center panel fairing consisting of 24ST alclad skin and formed "Z" stiffeners is riveted to the spar flanges on each side of the strut. A leading and trailing edge fairing is attached to each strut assembly by machine screws. These fairings consist of stamped ribs and skin. Flush riveting is used in attaching skin.

2-94. CENTER STRUT. The center strut consists of a heavy extruded beam with leading and trailing edge fairings riveted to the beam flanges. Construction of these fairings is similar to that of the side strut fairings. Attachment fittings are bolted to each end of the strut.

2-95. NEGLIGIBLE DAMAGE. (Refer to paragraph 1-38.) Dents, nicks, scratches, and small holes may be permitted in the fairings. Fatigue cracks may be stop drilled. Only minor nicks and scratches may be permitted on the spars at fittings.

SYMBOL	GAGE
▲	.025
●	.032
✳	.040

NOTE: ALL PLATING 75ST ALCLAD EXCEPT AS NOTED

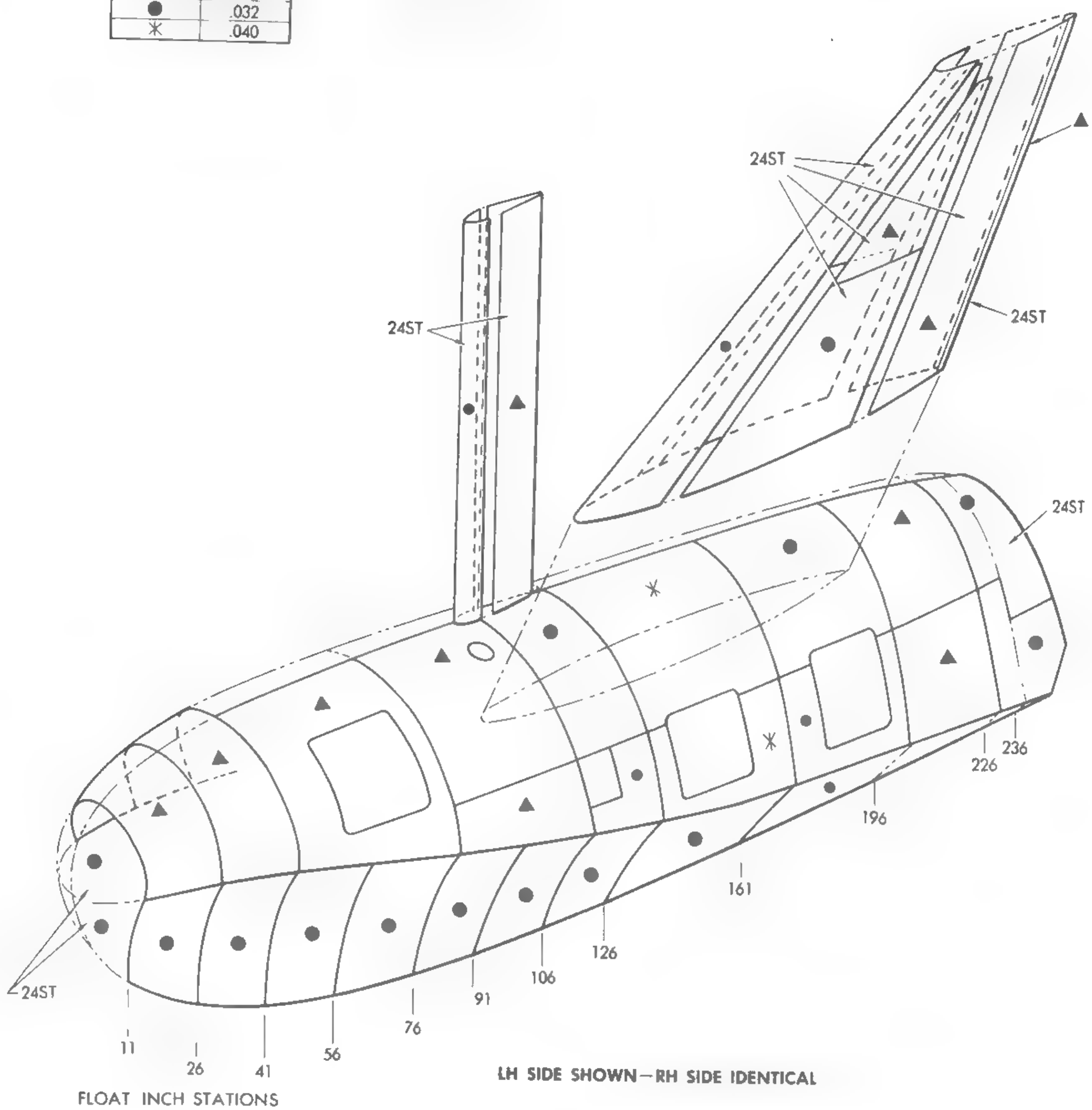


Figure 2-19. Auxiliary Float Plating

2-96. DAMAGE REPAIRABLE BY PATCHING. Repair principles outlined in Section I and illustrated in Appendix II are applicable. Flush skin patches are desirable but external patches applied with blind rivets are permissible. Due to the heavy gage of spar members, engineering action will be required for their reinforcement or splicing.

2-97. DAMAGE REPAIRABLE BY INSERTION. Repair principles outlined in Section I are applicable.

2-98. DAMAGE NECESSITATING REPLACEMENT OF PARTS. Attachment fittings must be replaced if damaged beyond negligible limits. It will probably be more practical to replace spars or spar rails than to repair them if damage is extensive.

SECTION III

TAIL GROUP

3-1. GENERAL. The tail group consists of a dorsal fin, vertical stabilizer, and horizontal stabilizer rigidly attached to the hull. A rudder is hinged to the vertical stabilizer and elevators are hinged to the horizontal stabilizers—each is equipped with a flight and a trim tab. (See figure 3-1 for a breakdown of components, figure 3-2 for station diagram, and figure 3-3 for skin gages and material.) The rudder and elevators and their control tabs are statically balanced. Refer to paragraph 1-81 and see figure 1-27 for balance requirements, methods, and tolerances.

3-2. DORSAL FIN. (See figure 3-4.)

3-3. GENERAL. The dorsal fin is permanently attached to the hull upper aft surface by bolts and rivets and to the vertical stabilizer by bolts and screws. Two removable leading edge sections are attached to the upper aft portion. The aft section is equipped for thermal anti-icing and will be discussed with the vertical stabilizer leading edge. Steps and hand grips are recessed along each side of the dorsal fin and equipped with self closing, spring loaded doors.

3-4. CONSTRUCTION. The basic structure consists of ribs, stiffeners, and stressed skin. The ribs are reinforced solid web with formed angle rails. The bottom point of each rib is equipped with a fitting which is attached to the hull by bolts. The stiffeners are formed "Z" members riveted to a stamped nose section. Rib and stiffener flanges and skin are dimpled for flush riveting. The skin is riveted to the hull skin along the base. The removable unheated leading edge section consists of stamped ribs and alclad skin. A spar is located at the base of the leading edge and consists of sheet stock web, extruded "T" rails and formed stiffeners. Forged fittings are incorporated for attachment to the vertical stabilizer by bolts. 75ST alclad is used throughout the structure with the exception of rib and spar webs, which are 24ST alclad.

3-5. NEGLIGIBLE DAMAGE. (Refer to paragraph 1-38.) Dents, nicks, scratches, and small holes are permitted. Fatigue cracks may be stop drilled pending repair if the crack is routed out and the edges smoothed. Any damage to the heated section of the leading edge which would interfere with its function is not negligible. (Refer to paragraphs 2-49 to 2-55 for details of function and repair.)

3-6. DAMAGE REPAIRABLE BY PATCHING. Repair principles as outlined in Section I and illustrated in Appendix II of this handbook are applicable. Flush skin repairs, dimpled and flush riveted, are desirable.

3-7. DAMAGE REPAIRABLE BY INSERTION. Repair principles as outlined in Section I are applicable to this component.

3-8. DAMAGE NECESSITATING REPLACEMENT OF PARTS. Attachment fittings should be replaced if damaged beyond negligible limits. The removable sections of the leading edge and the doors which cover the step and hand grip openings are readily replaceable if seriously damaged.

3-9. VERTICAL STABILIZER. (See figure 3-5.)

3-10. GENERAL. The vertical stabilizer is an internally braced, stressed skin, load bearing component. It consists of interspar structure, trailing edge, anti-ice leading edge and tip. It is attached to the hull by four mated fittings and bolts. Hoist and ladder attachment points are provided for handling and inspection. (See figure 1-11.)

3-11. INTERSPAR STRUCTURE. The interspar structure consists of front and rear spars, ribs and formers to which the stressed skin is attached by flush riveting. The spars are built up of sheet web, extruded angle rails and formed angle stiffeners. The majority of the ribs are open truss type, of formed "Z" sections curved to the contour of the ribs. A bulkhead consisting of a sheet web and formed angle rails is located forward of the front spar and extends from the dorsal fin spar attachment point to the base. The stressed skin is attached to this structure with 100° countersunk rivets.

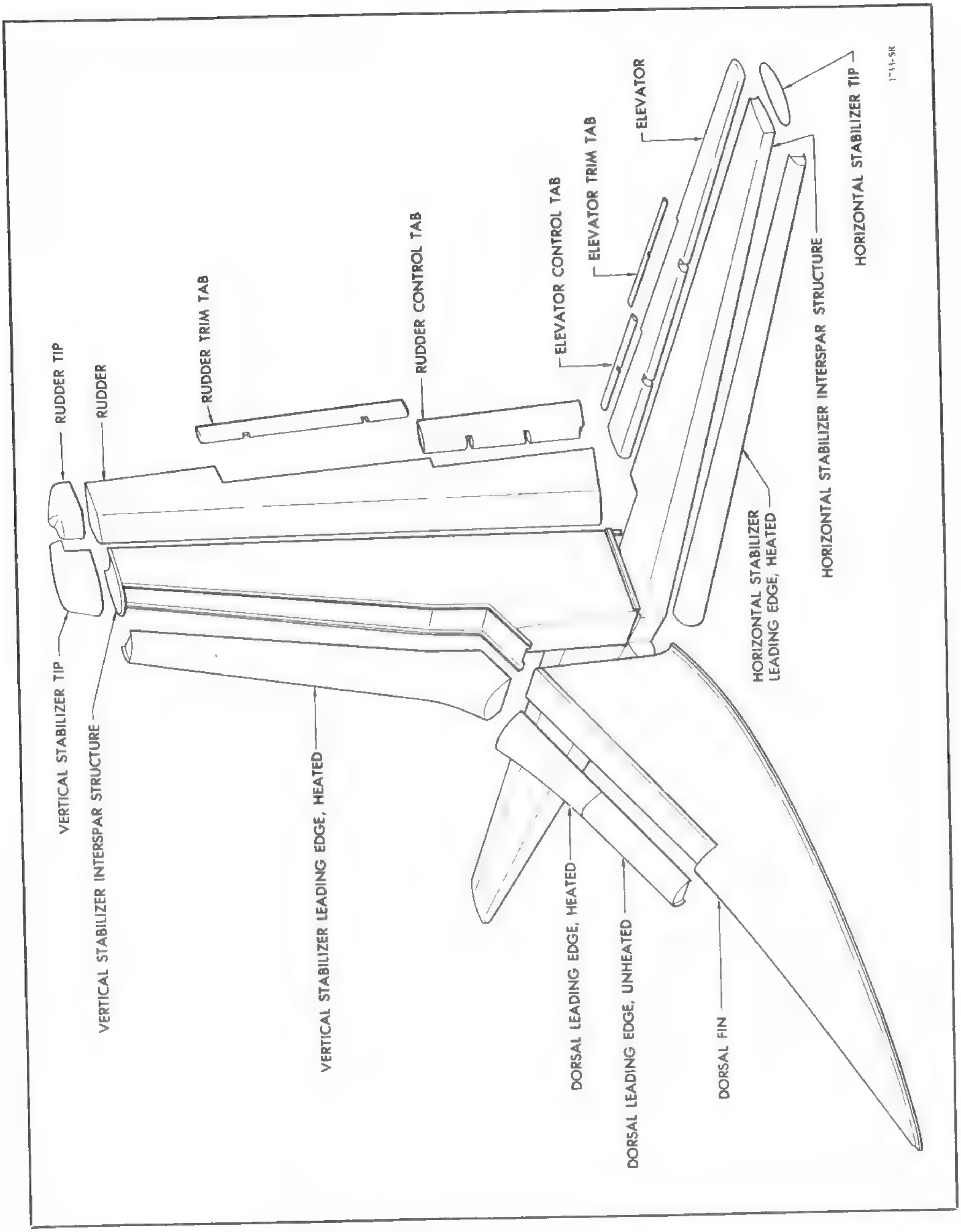


Figure 3-1. Tail Group Components

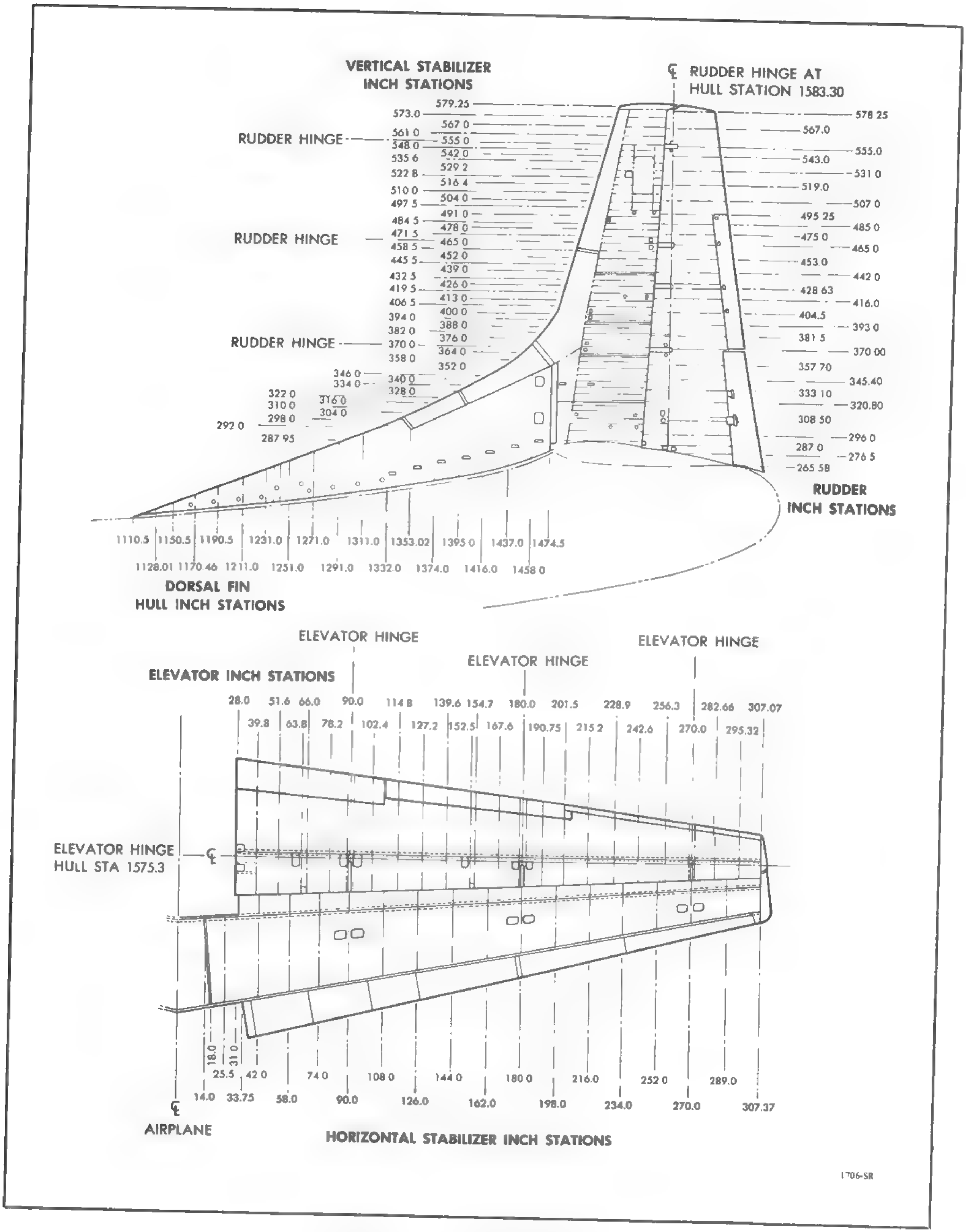


Figure 3-2. Tail Group Stations

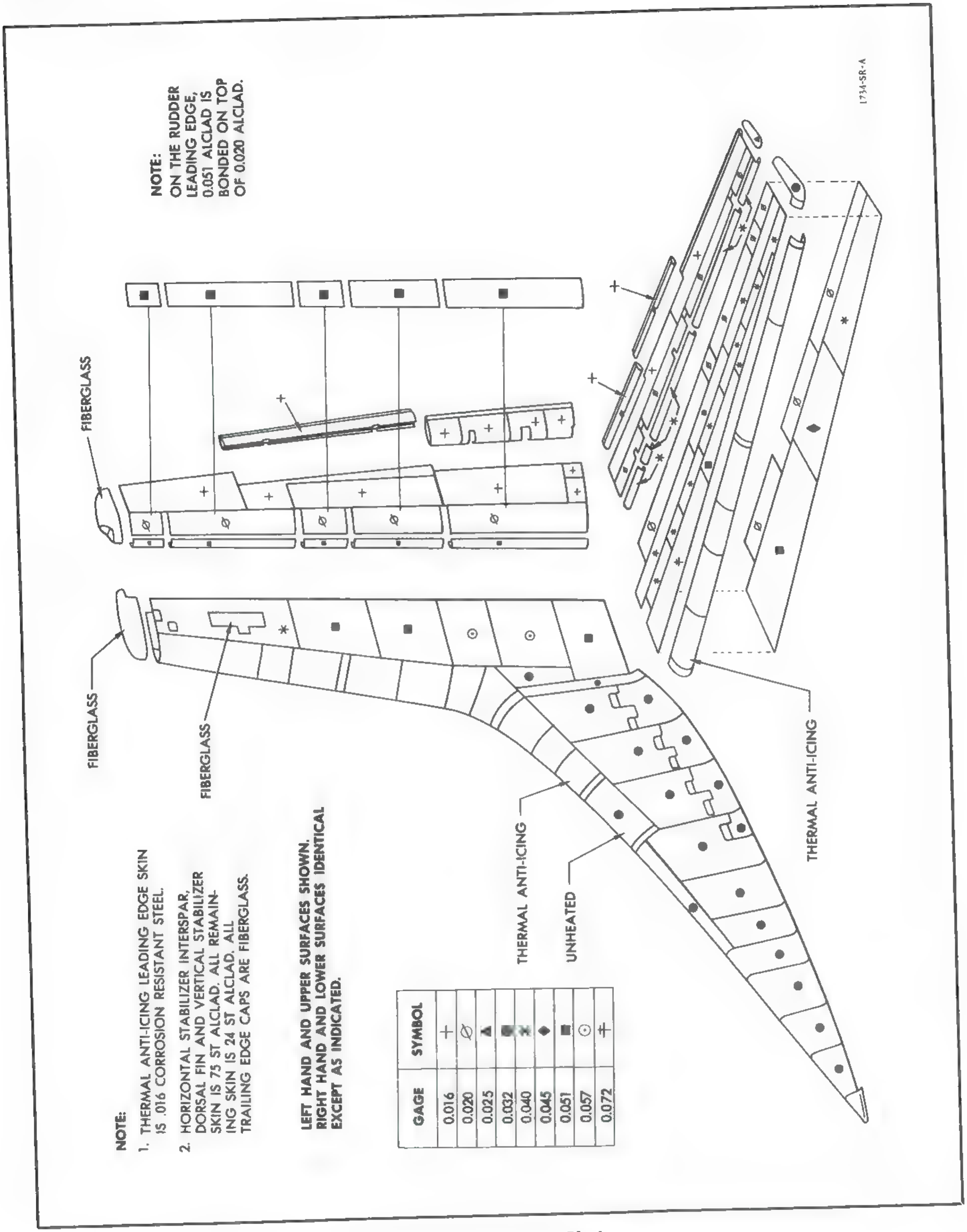


Figure 3-3. Tail Group Plating

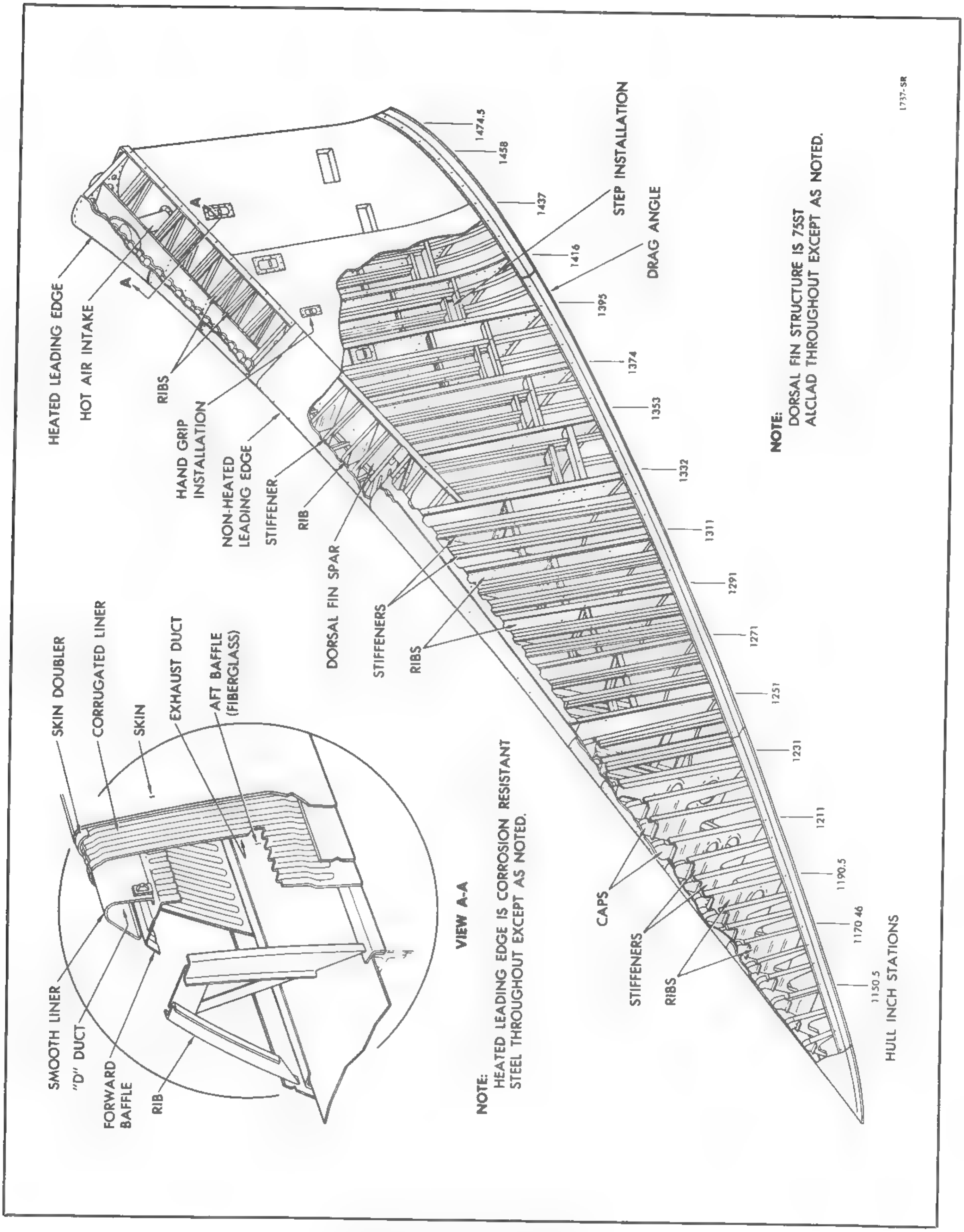


Figure 3-4. Dorsal Fin Structure

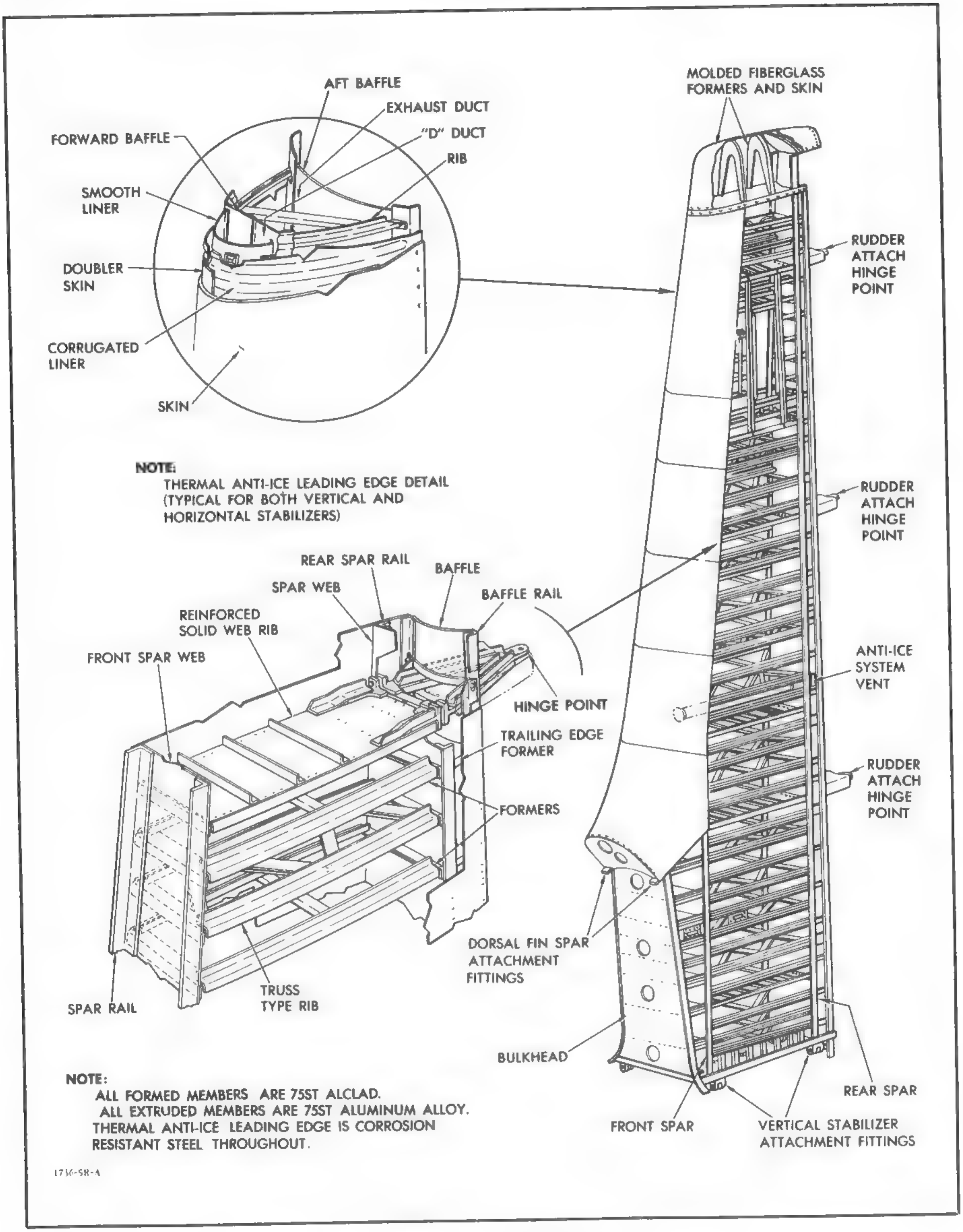


Figure 3-5. Vertical Stabilizer Structure

An opening, covered by fiberglas panels, is provided in each side of the upper portion for an antenna installation. The repair and handling is to be the same as the tip section.

3-12. NEGLIGIBLE DAMAGE. (Refer to paragraph 1-38.) Minor dents, scratches, nicks, and holes may be classed as negligible damage. Fatigue cracks may be stop drilled, pending repair, if the crack is routed out and the edges smoothed, except in the vicinity of attachment fittings and hinge brackets.

3-13. DAMAGE REPAIRABLE BY PATCHING. Repair principles as outlined in Section I and illustrated in Appendix II of this handbook are applicable. Flush type skin repairs, dimpled and riveted, are desirable. Repairs to spar rails at and near the stabilizer attachment fittings and rudder hinge brackets will require engineering approval.

3-14. DAMAGE REPAIRABLE BY INSERTION. Repair principles as outlined in Section I are applicable.

3-15. DAMAGE NECESSITATING REPLACEMENT OF PARTS. Attachment and hinge fittings damaged beyond negligible limits must be replaced. Steel bushings in these fittings may be replaced with standard parts. Substitution or alteration will require engineering approval. (Refer to paragraphs 3-18 to 3-22 for information on repair, replacement or refinish of the fiberglas antenna cover panels.)

3-16. LEADING EDGE. (See figure 3-5.)

3-17. GENERAL. The thermal anti-ice leading edge as installed on the vertical and horizontal stabilizers is similar in construction and identical in function to the wing leading edge. Hot exhaust gases are introduced at the center section of the anti-ice leading edge and are exhausted through ports on either side of the trailing section aft of the vertical stabilizer rear spar. (Refer to paragraphs 2-49 to 5-55 for operation, negligible damage and repair.)

3-18. VERTICAL STABILIZER AND RUDDER TIP. (See figures 3-5 and 3-8.) These units are attached to the upper ends of stabilizer and rudder with screws and serve as a streamline fairing. The stabilizer tip also serves as a housing for an antenna installation.

3-19. CONSTRUCTION. The vertical stabilizer and rudder tips and antenna cover panels located on each side of the vertical stabilizer are molded sandwich type fiberglas plastic. The tip sections are molded to contour. including internal reinforcements. No fasteners are employed in their fabrication.

3-20. NEGLIGIBLE DAMAGE. Scratches and nicks may be classed as negligible. Cracks are not permitted.

3-21. DAMAGE REPAIRABLE BY PATCHING OR INSERTION. Metallic repairs are not permitted on any of these units because of interference with antenna reception. (Refer to paragraph 1-75.)

NOTE

Do not refinish these units with ordinary exterior finish. A semi-conductive finish is applied and should be supervised by an electronics technician.

3-22. DAMAGE NECESSITATING REPLACEMENT. Holes or cracks in these units will necessitate replacement of the unit.

3-23. VERTICAL AND HORIZONTAL STABILIZER TRAILING EDGES. These sections are attached to the rear spars and serve as a fairing between the interspar structure and movable controls.

3-24. CONSTRUCTION. The structure consists of stamped ribs, spanwise trailing edge rails, aft curved baffle, and skin. Skin and ribs are dimpled and flush riveted. 24ST alclad is used throughout.

3-25. NEGLIGIBLE DAMAGE. The full range of negligible damage described in paragraph 1-38 may be permitted in this area. Distortion which would interfere with air flow or with operation of controls will require repair.

3-26. DAMAGE REPAIRABLE BY PATCHING. Repair principles outlined in Section I and illustrated in Appendix II are applicable in these areas. Flush type skin patches, dimpled and flush riveted, are desirable.

3-27. DAMAGE REPAIRABLE BY INSERTION. Repair principles outlined in Section I are applicable.

3-28. DAMAGE NECESSITATING REPLACEMENT OF PARTS. Due to the relatively small parts involved, replacement may be more economical than repair.

3-29. HORIZONTAL STABILIZER. (See figure 3-6.)

3-30. GENERAL. The horizontal stabilizer consists of an integral left and right interspar section with separate leading and trailing edges. The interspar section is attached to the hull by four mated and bolted fittings and by riveting to the hull skin on the lower surface.

3-31. INTERSPAR STRUCTURE. The interspar structure is the load bearing section of the horizontal tail group. It consists of front and rear spars, spanwise stringers, chordwise ribs, and stressed skin. The spars are built up of sheet stock webs and extruded "T" rails. The stringers are extruded "Z" members. (See figure 3-7.) The inboard stringers are machined from heavy extrusions and are tapered. The ribs are of two types, both reinforced solid web and open truss type being used. Intercostals are used to connect the skin to the ribs between stringers. The skin is attached to spars, stringers and intercostals with 100° countersunk head rivets throughout. 75ST aluminum alloy and alclad are the materials employed in construction.

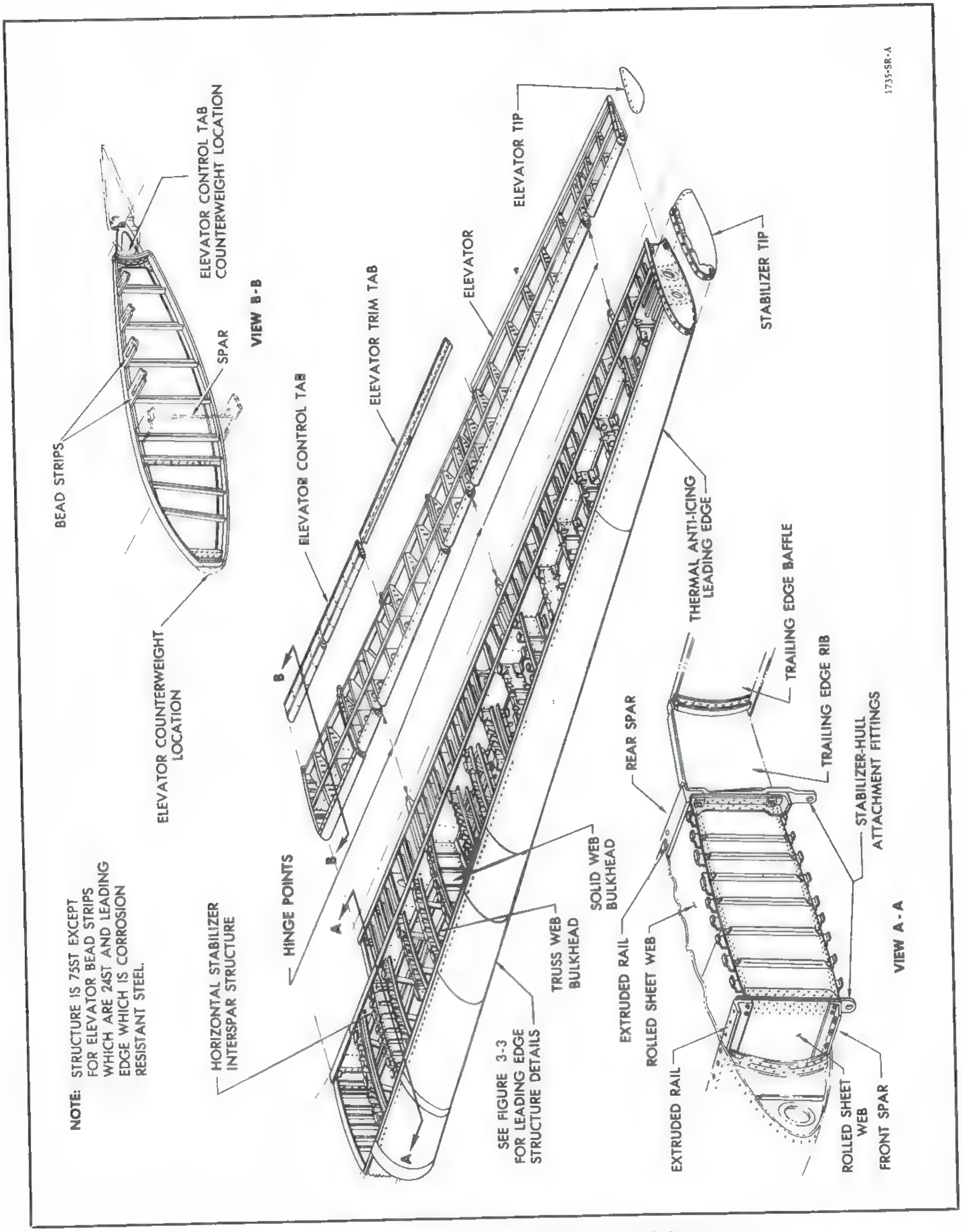
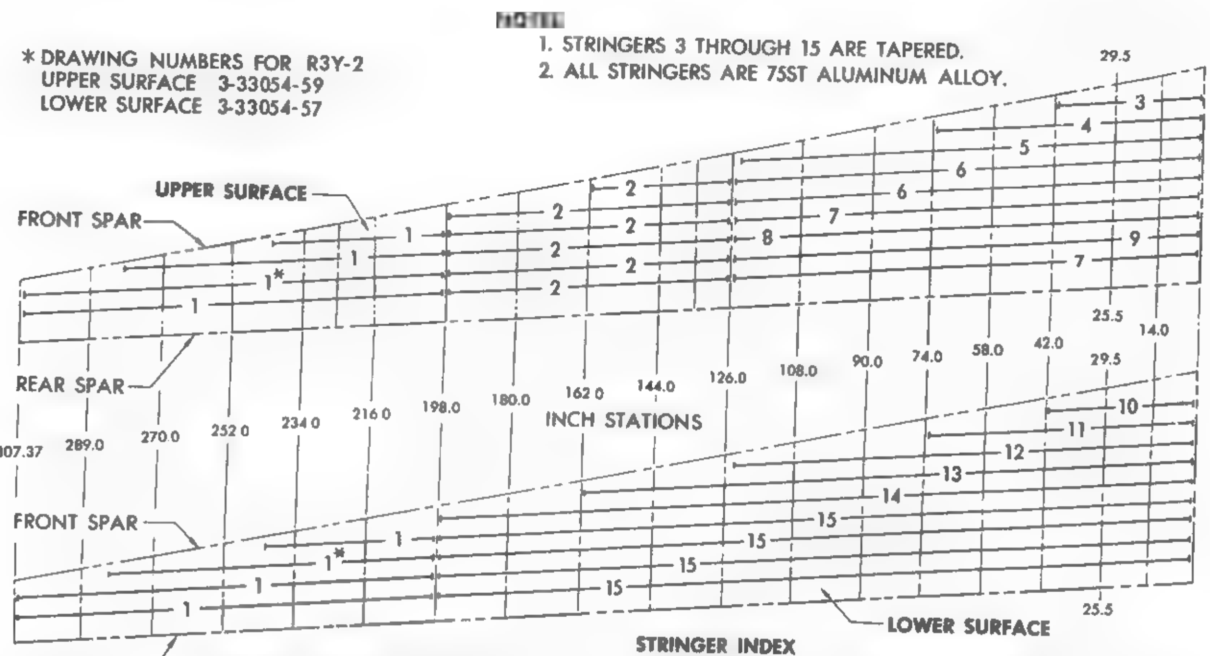


Figure 3-6. Horizontal Stabilizer, Elevator and Tab Structure



STRINGER INDEX

INDEX NO.	EXTRUSION NUMBER	DRAWING NUMBER	INDEX NO.	EXTRUSION NUMBER	DRAWING NUMBER	INDEX NO.	EXTRUSION NUMBER	DRAWING NUMBER
1	K32733		6	K43205	3-11110-9	11	K43205	3-11119-7
2	K32735		7	K43205	3-11111-11	12	K43205	3-11120-7
3	K43205	3-11107-7	8	K43205	3-11111-14	13	K43205	3-11121-7
[illegible]	K43205	3-11108-7	9	K43205	3-11111-13	14	K43205	3-11122-7
5	K43205	3-11109-7	10	K43205	3-11118-7	15	K43205	3-11123-7

1804-SR

Figure 3-7. Horizontal Stabilizer Stringer Diagram

3-32. NEGLIGIBLE DAMAGE. (Refer to paragraph 1-38.) Due to the highly stressed condition and importance of the interspar structure, minor dents, scratches, nicks and holes are all which can be classed as negligible. Fatigue cracks must be repaired at once.

3-33. DAMAGE REPAIRABLE BY PATCHING. Repair principles outlined in Section I and illustrated in Appendix II are applicable. Flush type skin repairs, dimpled or machined countersunk and flush riveted, are desirable. Repair to spar rails, tapered stringers, skin at spar rails or elevator hinge support brackets will require engineering approval.

3-34. DAMAGE REPAIRABLE BY INSERTION. Repair principles outlined in Section I are applicable.

3-35. DAMAGE NECESSITATING REPLACEMENT OF PARTS. Fittings damaged beyond negligible limits must be replaced. Elevator hinge support bracket major damage would probably require replacement of the bracket. They are attached to the rear spar by bolts.

3-36. HORIZONTAL STABILIZER LEADING EDGE. Similar to vertical stabilizer leading edge. (Refer to paragraph 3-17.)

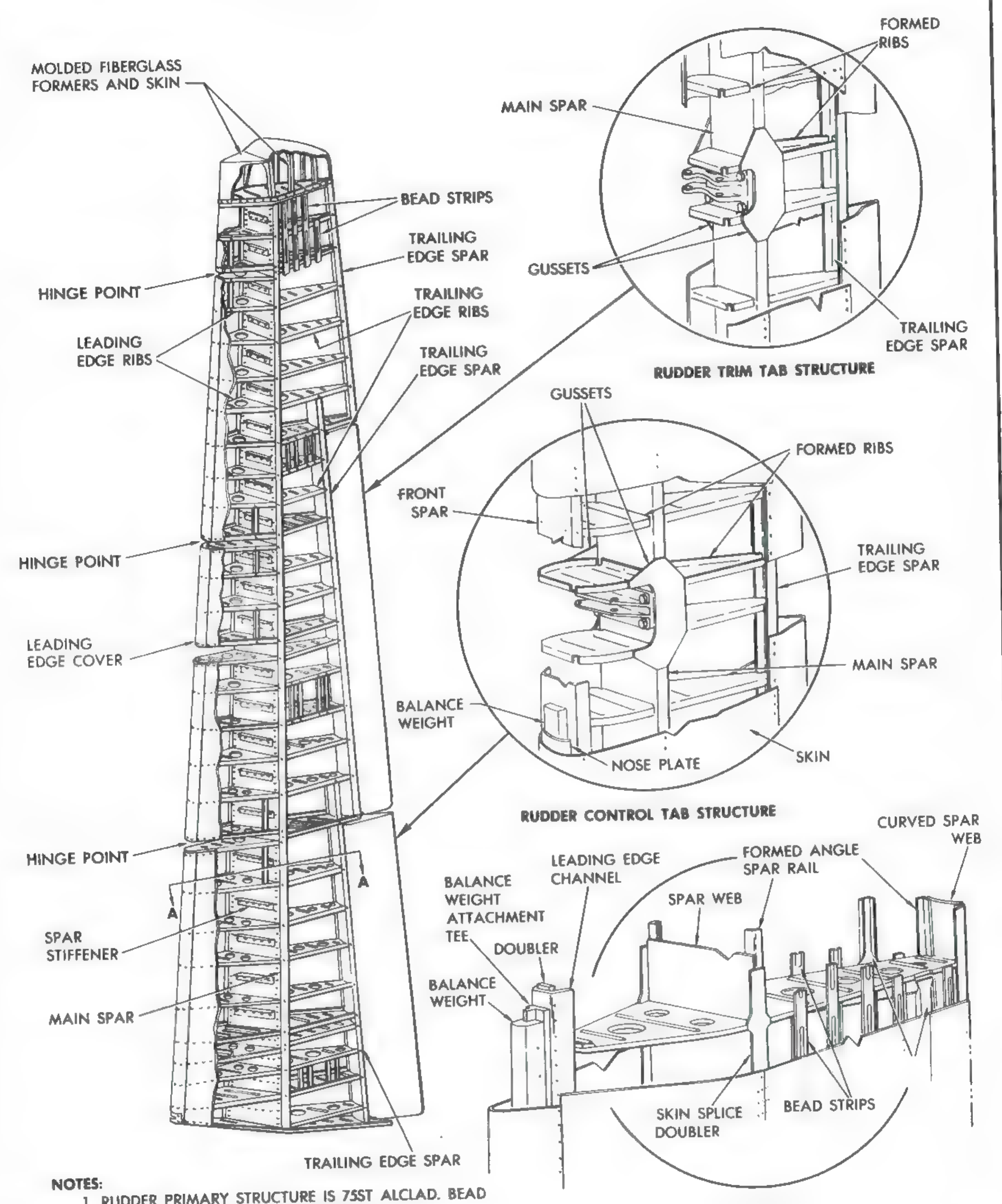
3-37. HORIZONTAL STABILIZER TRAILING EDGE. (Refer to paragraphs 3-23 to 3-28.)

3-38. MOVABLE TAIL COMPONENTS. (See figures 3-6 and 3-8.)

3-39. GENERAL. These components consist of rudder, elevators and their flight and trim tabs. The rudder and elevators are attached to the stabilizer interspar structures at three hinge points each. Each must be in static balance when its flight and trim tab is installed. Each flight tab is individually balanced. (Refer to paragraphs 1-81 to 1-87 for details. See figure 1-27 for equipment and tolerances.) The trim tabs are not balanced, but must be installed when the parent control is being checked.

3-40. CONSTRUCTION.

3-41. RUDDER. The structure consists of spars, ribs, bead strips and stressed skin. The main spar is built up with a sheet stock web and formed angle rails. The rear spar is in three sections and serves as a baffle at the tab cutouts. Reinforced spar sections are provided at the leading edge for mounting counterweights. Ribs are hydropress stampings with flanged lightning holes. The



NOTES:

1. RUDDER PRIMARY STRUCTURE IS 75ST ALCLAD. BEAD STRIPS AND FILLERS ARE 24ST ALCLAD.
2. CONTROL AND TRIM TAB MAIN SPARS ARE 75ST ALCLAD. ALL REMAINING STRUCTURE IS 24ST ALCLAD.

Figure 3-8. Rudder and Tab Structure

spanwise bead strips are roll formed equivalents of stringers. The stressed skin is attached to spars, ribs and bead strips, employing flush seams and riveting. The main spar and ribs are 75ST aluminum alloy and alclad. The remainder of the structure is 24ST alclad. Trailing edge cap is fiberglas.

3-42. ELEVATORS. The elevator structure is basically the same as that of the rudder. Main spar and ribs are 75ST aluminum alloy and alclad. Trailing edge cap is fiberglas. The remaining structure and skin is 24ST alclad. The elevators are connected by a torque tube but are replaceable separately.

3-43. FLIGHT (CONTROL) TABS. Rudder and elevator flight tabs are very similar in construction. They consist of a formed channel main spar, stamped leading and trailing edge ribs, leading and trailing edge channel spars and stressed skin. Counterweights are located in the leading edge of each. Spars are 75ST alclad. Ribs and skin are 24ST alclad. Trailing edge caps are fiberglas. Flush riveting is used throughout.

3-44. TRIM TABS. Rudder and elevator trim tabs are also very similar in construction. They consist of main and rear spars, leading and trailing edge ribs and skin. The leading edge is open and no counterweights are installed. Trailing edge cap is fiberglas. Spars are 75ST alclad. Ribs and skin are 24ST alclad. Flush riveting is used throughout.

3-45. NEGLIGIBLE DAMAGE. (Refer to paragraph 1-38.) Generally, stresses are not high in any of these components except for the spars and the areas adjacent to hinge and actuating control attachment points. Due to the importance of the controls, any damage in these areas, especially fatigue cracks and loose or sheared rivets should be repaired at once. Scratches, minor dents, small holes and fatigue cracks which have been stop drilled may be classed as negligible damage, pending repair, in other areas. However, any damage which distorts the aerodynamic shape of the components may never be classed as negligible.

3-46. DAMAGE REPAIRABLE BY PATCHING. Repair principles outlined in Section I and illustrated in Appendix II are applicable for these components. Any repairs to spar or skin adjacent to hinge or actuating control attachments points, or the use of external patches or protruding head or blind rivets will require engineering approval. Damaged trailing edge cap may be repaired as illustrated in figure B-9, Appendix II, and should be symmetrical on both sides of the cap.

3-47. DAMAGE REPAIRABLE BY INSERTION. Repair principles outlined in Section I are applicable for these components. Damaged sections of fiberglas trailing edge cap may be replaced with ends spliced as illustrated in figure B-9, Appendix II.

3-48. DAMAGE NECESSITATING REPLACEMENT OF PARTS. Hinge and actuating control attachment fittings must be replaced if damaged beyond negligible limits. Control and trim tabs, rudder and elevators may be replaced individually if damaged beyond economical repair.

NOTE

> Repair, refinish or replacement of any control surface or tab will necessitate check of static balance. (Refer to paragraphs 1-81 to 1-87 and see figure 1-27 for balance requirements, methods and tolerances.)

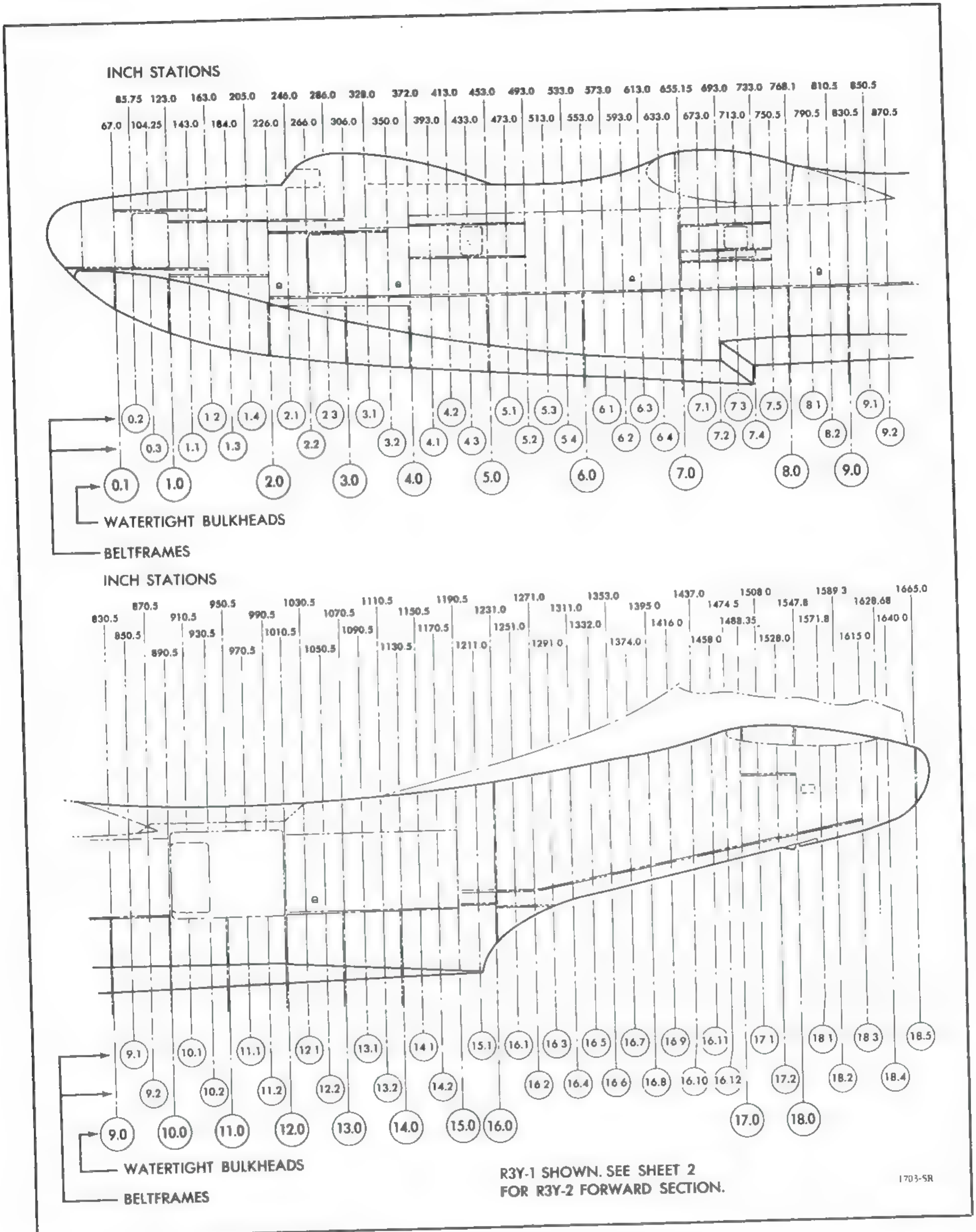


Figure 4-1. Hull Station Diagram (Sheet 1 of 2)

SECTION IV

BODY

4-1. HULL ASSEMBLY. (See figure 4-1 for hull stations.)

4-2. GENERAL. The hull is manufactured in three sections: nose, cargo and aft. They are mated at bulkheads 4.0 and 16.0. The type of construction used in each is very similar. There are three special categories of repairs with special requirements in addition to structural and aerodynamic. These categories are watertight, airtight, and weathertight. Placing repairs in these categories is a matter of location. These locations and methods of meeting the requirements are as follows:

4-3. WATERTIGHT. This type of joint or seam is obtained by the application of zinc chromate tape to faying surfaces before riveting. Rolled tape or zinc chromate paste may be added to fill larger voids at corners. Rivet patterns must consist of at least two rows of rivets, staggered, and with a maximum pitch of 4xD (D equals rivet shank diameter). For reasons of structural strength, pitch must not be less than 4xD. For seam tightness it should be not more than 4xD + 10 percent. This 10 percent is allowed to facilitate layout of rivet patterns. Other variations will require engineering approval. The location where this category repair is required is any skin or watertight bulkhead repair below waterline 99 inches. (The cargo compartment floor is at waterline 100 inches.) In the pressurized section of the hull these repairs must also be airtight. Any leaks must be repaired by re-caulking and re-riveting. Surface application of zinc chromate paste or sealer, EC801, is not permitted.

4-4. AIRTIGHT. This type of seam or point is identical to the watertight seam with one exception: any small leaks above waterline 99 inches may be sealed by the application of sealer, EC801, to the inside surface. All zinc chromate primer must be removed and the surface cleaned with Methyl Ethyl Ketone before this application. The area should be re-primed after the sealer has set. Locations where this type of repair is required are all external skin in the pressurized area above waterline 99 inches, and the pressure bulkheads at 1.0 in the R3Y-1 and at 16 in the R3Y-1 and R3Y-2. In addition, the part of bulkhead 3.0 aft of the pilots' compartment which extends above the normal hull contour and is covered by the radome canopy on the R3Y-1, must be airtight. In the R3Y-2 this location is bulkhead 4.0 instead. Also, the lavatory floor between bulkheads 15.0 and 16.0 in both models must be airtight.

4-5. WEATHERTIGHT. The same type of seam sealing is prescribed as for watertight but is not so critical. Sealing only needs to be against rain and spray. Location will be all external hull skin not covered in paragraphs 4-3 and 4-4.

4-6. HULL CONSTRUCTION.

4-7. GENERAL. The basic structure of the hull consists of bulkheads, stringers, longerons, stiffeners, keel, chine, stressed skin and internal flooring. They will be dealt with separately in the following paragraphs. This information will be applicable to both the R3Y-1 and R3Y-2. Special features of the R3Y-2 bow door and ramp will be described following the hull description.

4-8. BULKHEADS. (See figure 4-1 for bulkhead station locations. See figure 4-2 for structural arrangement.)

4-9. GENERAL. There are 16 watertight bulkheads. These differ from the intermediate bulkheads only below the floor level. Bulkheads 1.0 (R3Y-1 only) and 16.0 differ above the floor level in that they are airtight throughout. Bulkheads 2.0 and 3.0 (R3Y-1 only) differ in that they are solid web construction except for a door opening and they serve as a support for the flight deck beams. They are not pressure bulkheads. In the R3Y-2 the entire flight operations deck is above the cargo area. Frames and bulkheads between stations 1.1 and 3.3 are modified to provide this space and incorporate members to support the flight deck floor. Special consideration has been given belt frame stations 4.1 to 7.2 below the floor due to their importance during takeoff and landing. Extra angles, fillers and stiffeners are employed to give a more stable construction. Above the floor on beltframe stations 5.3, 5.4, and bulkhead station 6.0 some extra members have been used on the frames and the rivet frequency on skin to hull attachment is double the normal pattern to insure a stronger

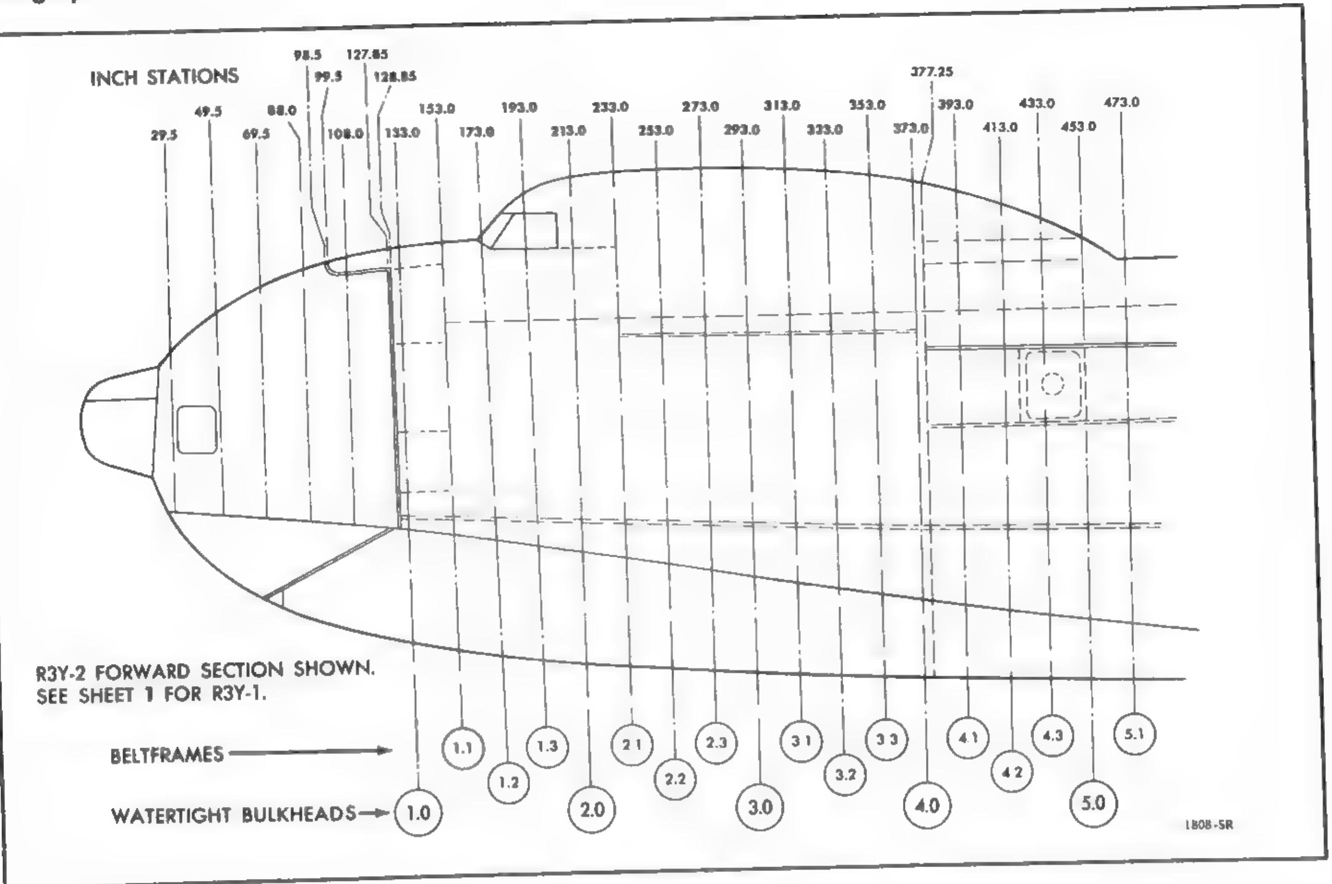


Figure 4-1. Hull Station Diagram (Sheet 2 of 2)

and more stable installation. Bulkheads 7.0 and 8.0 differ in that they are heavy box beams and serve as wing attachment members. Aft of station 16 there is no chine and keel and the structure is much lighter. Bulkheads 17.0 and 18.0 are heavily reinforced for attachment of tail surfaces. For clarity, the members located between watertight bulkheads will be called beltframes. These bulkheads and frames are built up of sheet alclad web, extruded angle and "T" outer and inner rails and reinforced by stiffeners. Frames and bulkheads above the floor are equipped with intercostals located between stringers for attachment of skin. Below floor level skin is attached directly to the bulkhead rails. The cargo compartment floor is supported by the reinforced web of bulkheads and frames.

4-10. NEGLIGIBLE DAMAGE. (Refer to paragraph 1-38.) Small dents, nicks, scratches, and holes in the webs and rails of beltframes and bulkheads—above waterline 99 inches and in not more than one frame in a series of three—may be classed as negligible. Exceptions are bulkheads 1.0 and 16.0 of the R3Y-1 and bulkhead 16.0 of the R3Y-2. These pressure bulkheads are very highly stressed when the cabin is pressurized and no damage except the most minor scratches and dents may be ignored. Any loose fasteners or distorted members must be repaired at once. No holes may be permitted in the pressure bulkheads or in the watertight sections of other bulkheads. Dents must be investigated for possible transmitted structural damage or attendant air or water leaks. Fatigue cracks must be repaired at once and must be watched for especially in pressure bulkheads, wing attachment area, and at tail surface attachment fittings.

4-11. DAMAGE REPAIRABLE BY PATCHING. Repair principles outlined in Section I and illustrated in Appendix II are applicable. (See figure 4-5 for a frame repair. See figure 4-6 for a hull bottom repair at a watertight bulkhead.) Repairs to heavier members, as at wing and tail attachment or pressure bulkheads, will require engineering approval. Water and airtight requirements must be observed as needed according to location.

4-12. DAMAGE REPAIRABLE BY INSERTION. Repair principles outlined in Section I are applicable.

4-13. DAMAGE NECESSITATING REPLACEMENT OF PARTS. Fittings damaged beyond negligible limits must be replaced. Short members such as intercostals and many stiffeners, braces, and bulkhead corner seal cups should be replaced instead of repaired.

4-14. STRINGERS. (See figure 4-3.) (See Section VIII for extrusion information.)

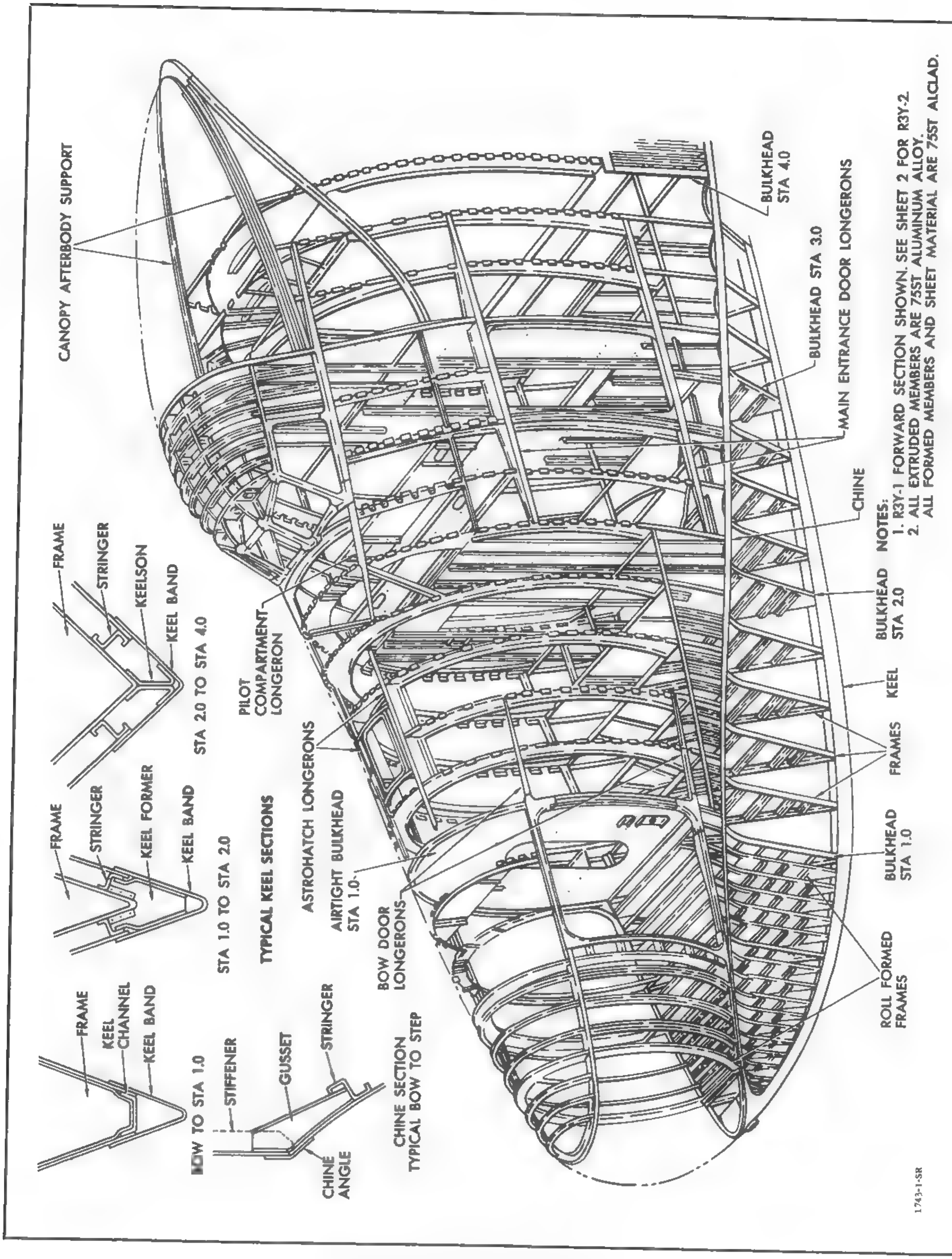


Figure 4-2. Hull Structure (Sheet 1 of 5)

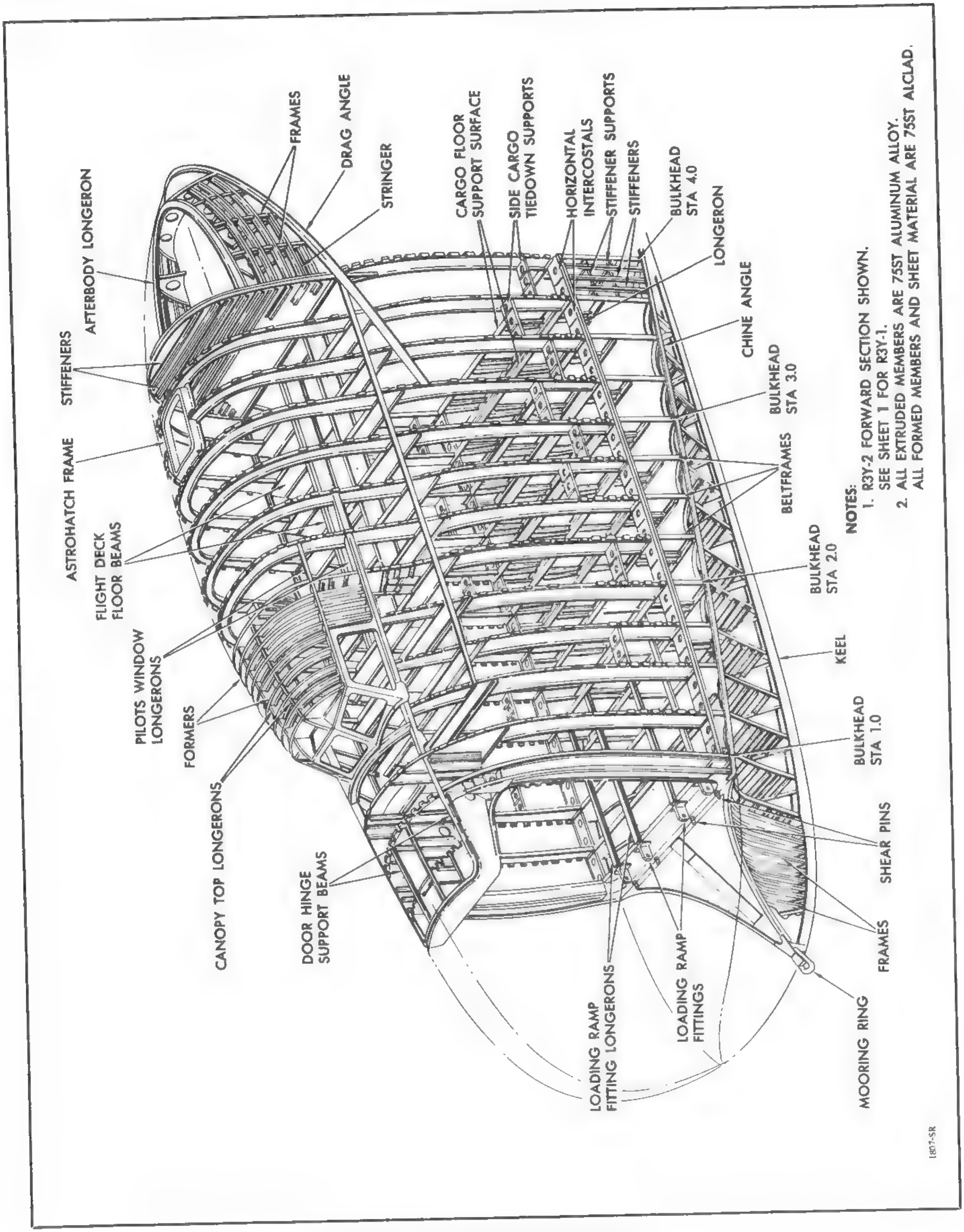


Figure 4-2. Hull Structure (Sheet 2 of 5)

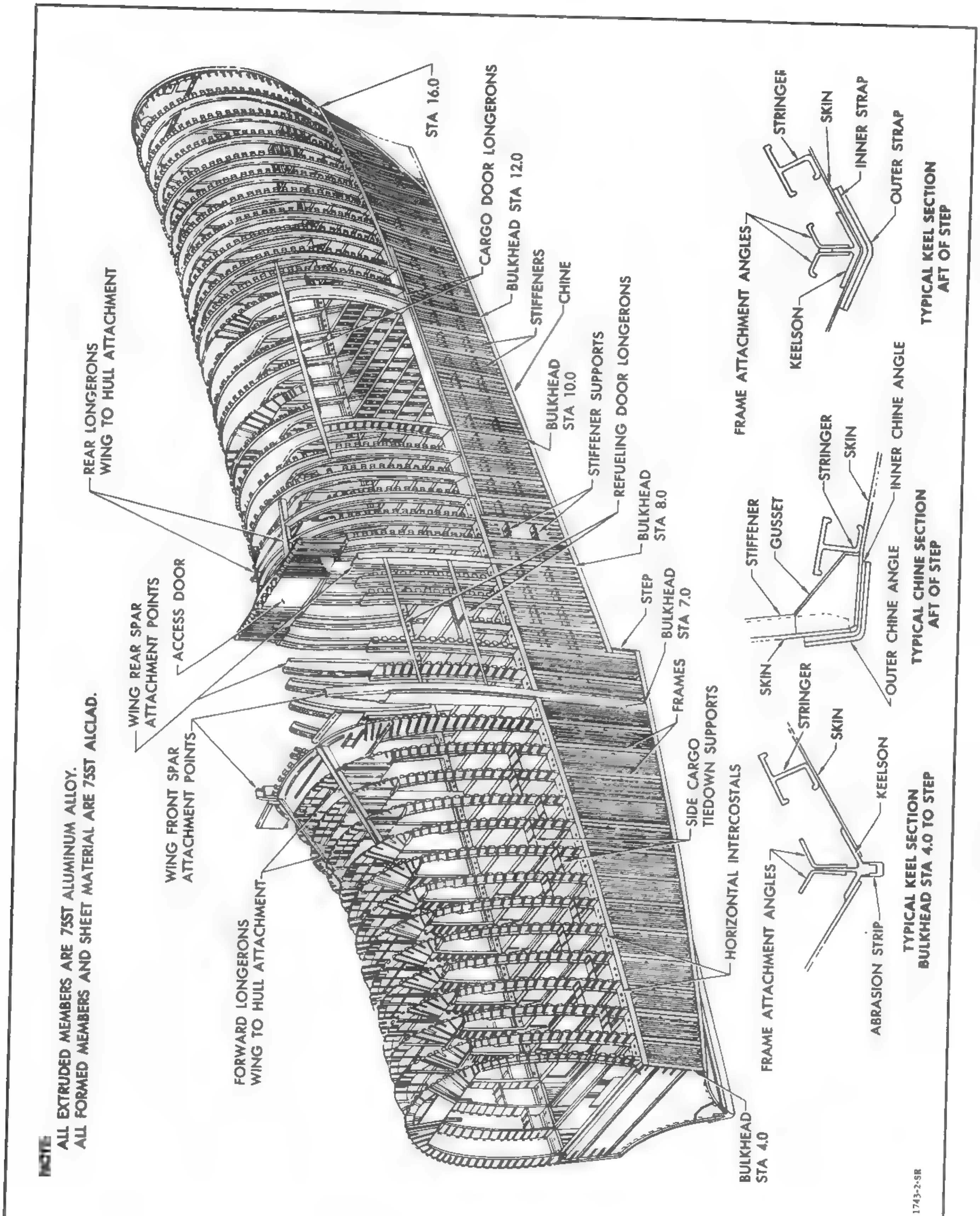


Figure 4-2. Hull Structure (Sheet 3 of 5)

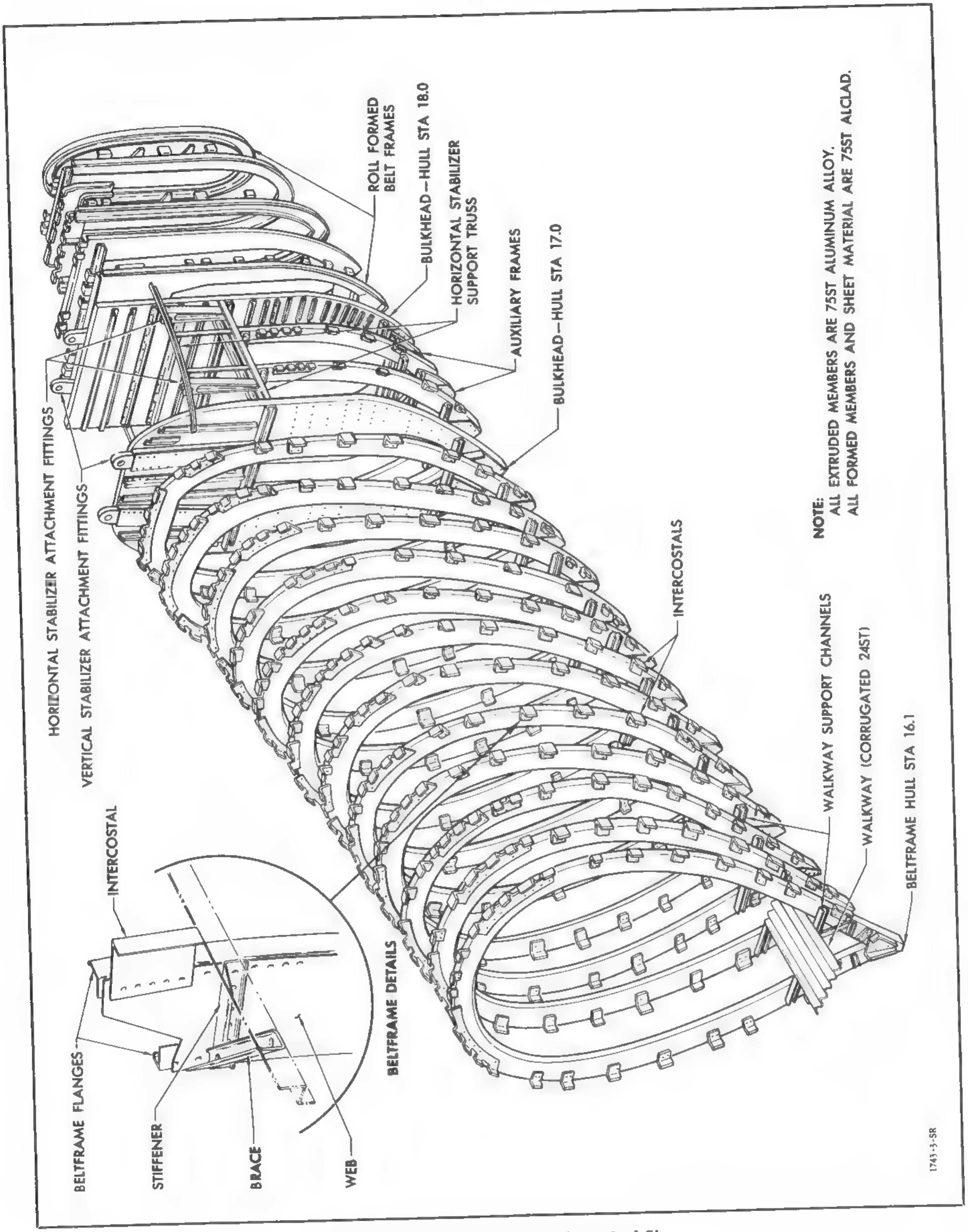


Figure 4-2. Hull Structure (Sheet 4 of 5)

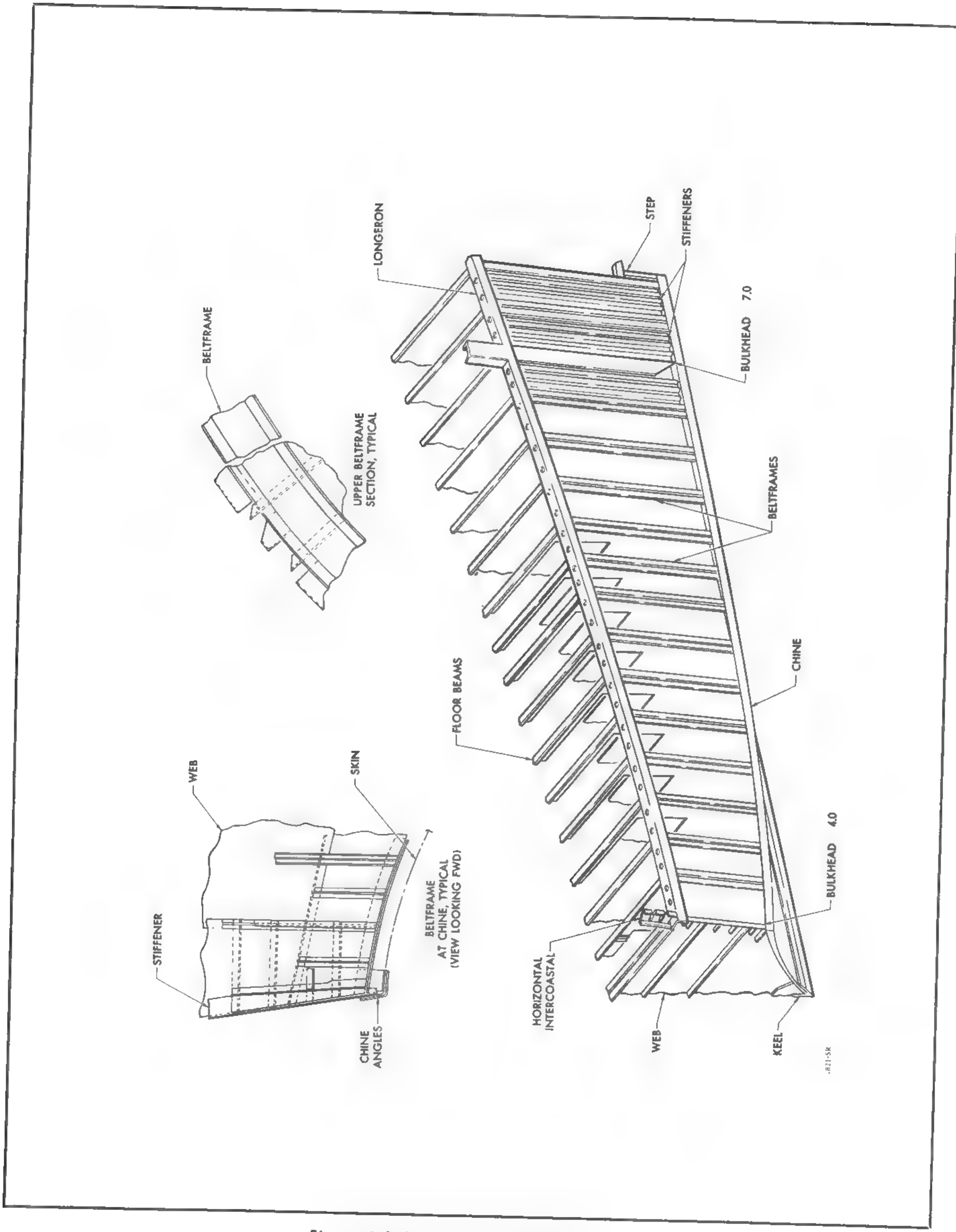
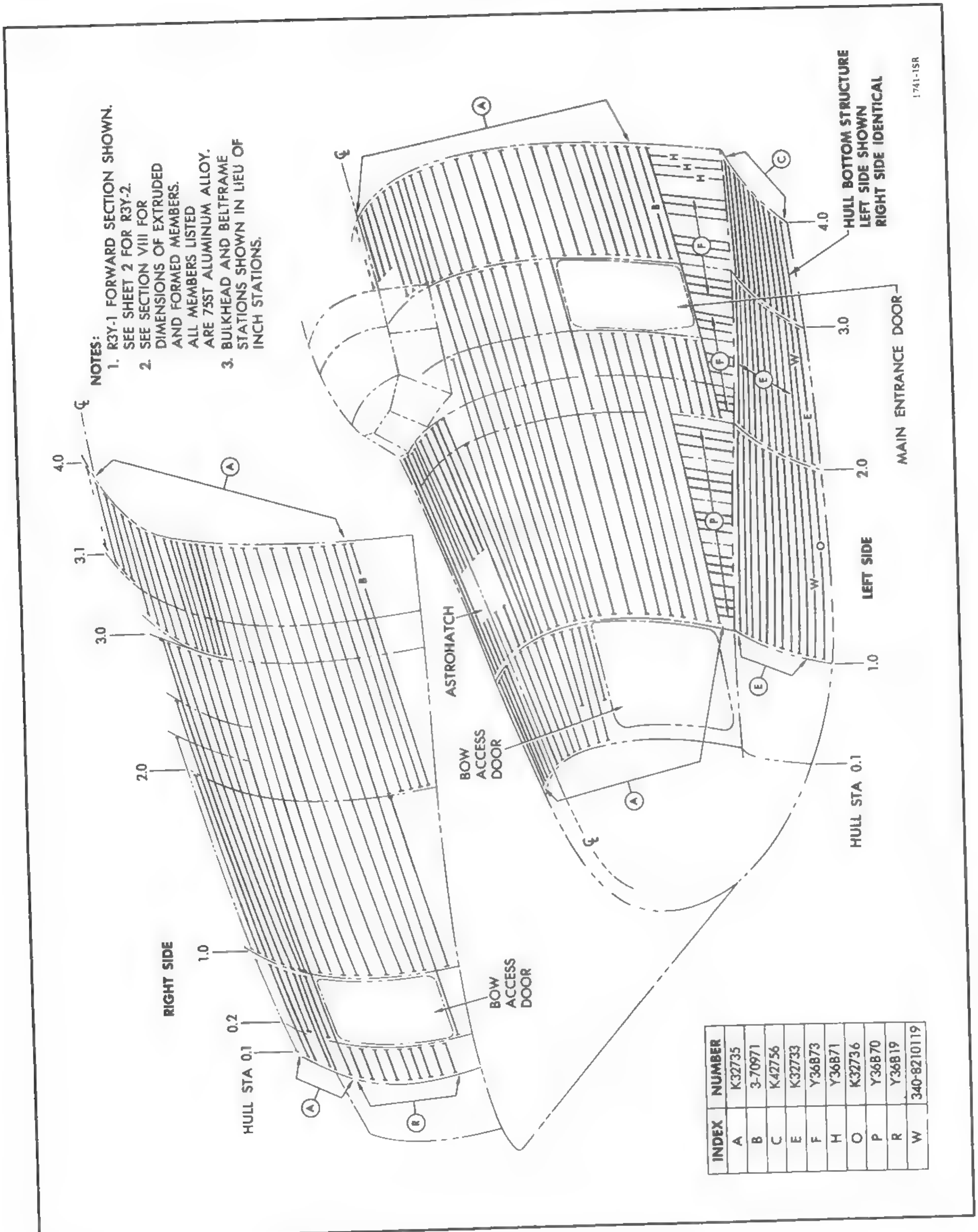


Figure 4-2. Hull Structure (Sheet 5 of 5)



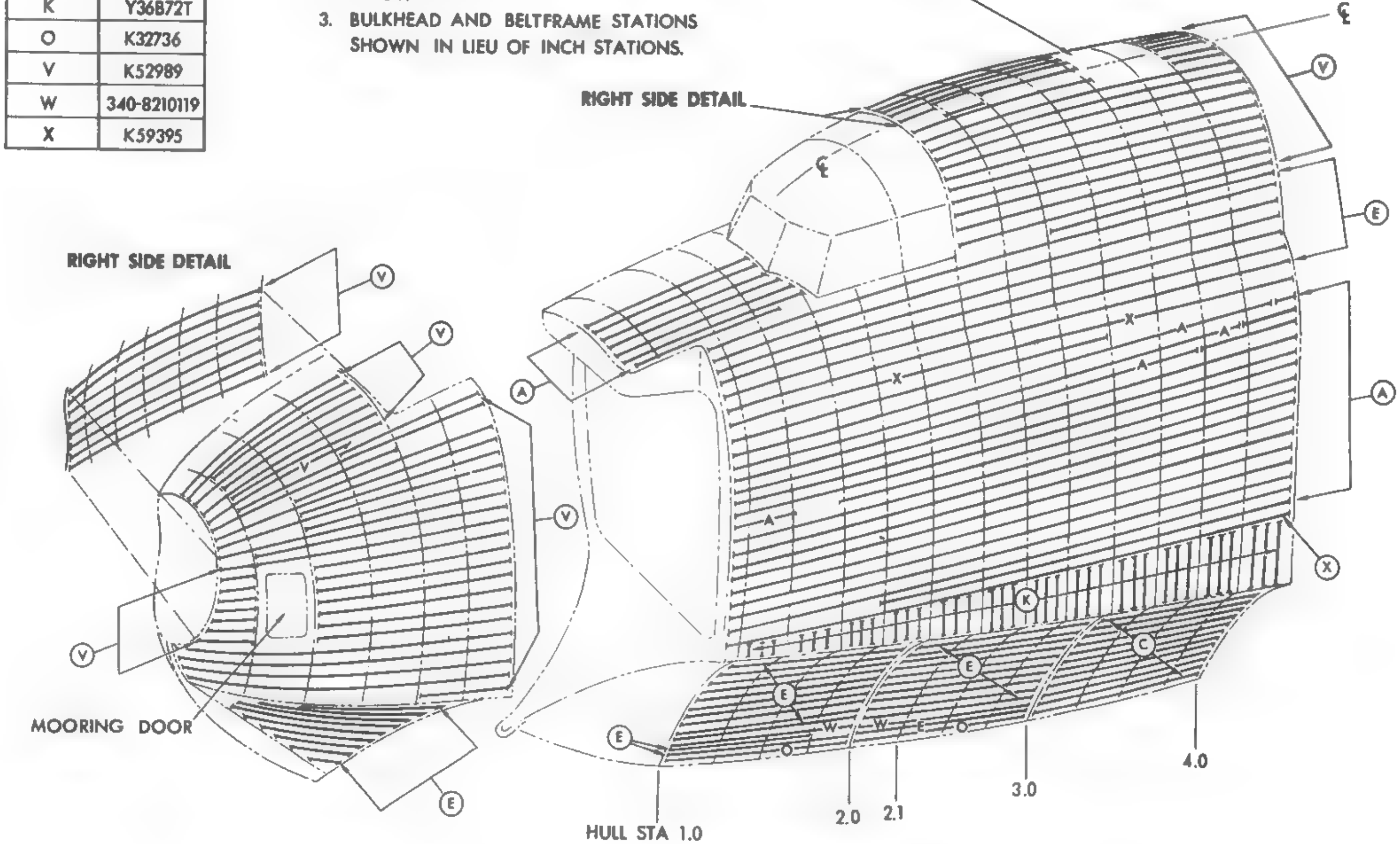
INDEX	NUMBER
A	K32735
B	3-70971
C	K42756
E	K32733
F	Y36B73
H	Y36B71
O	K32736
P	Y36B70
R	Y36B19
W	340-8210119

Figure 4-3. Hull Stringer Diagram (Sheet 1 of 5)

INDEX	NUMBER
A	K32735
C	K42756
E	K32733
K	Y36B72T
O	K32736
V	K52989
W	340-8210119
X	K59395

NOTES:

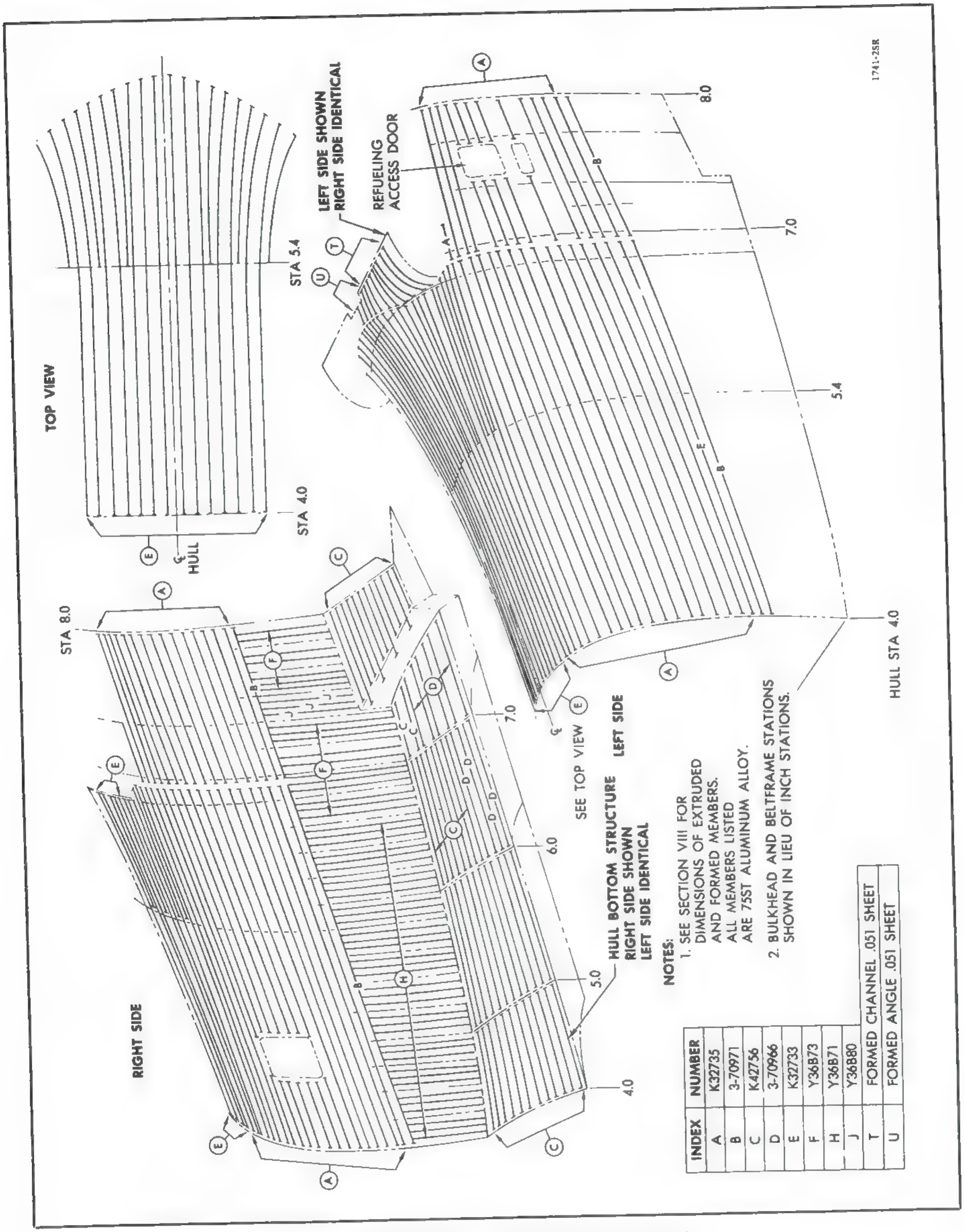
1. R3Y-2 FORWARD SECTION SHOWN. SEE SHEET 1 FOR R3Y-1.
2. SEE SECTION VIII FOR DIMENSIONS OF EXTRUDED AND FORMED MEMBERS. ALL MEMBERS LISTED ARE 75ST ALUMINUM ALLOY.
3. BULKHEAD AND BELTFRAME STATIONS SHOWN IN LIEU OF INCH STATIONS.



BOW DOOR. LEFT SIDE SHOWN. RIGHT SIDE IDENTICAL EXCEPT AS INDICATED.

HULL FORWARD SECTION. LEFT SIDE SHOWN. RIGHT SIDE IDENTICAL EXCEPT AS INDICATED.

Figure 4-3. Hull Stringer Diagram (Sheet 2 of 5)

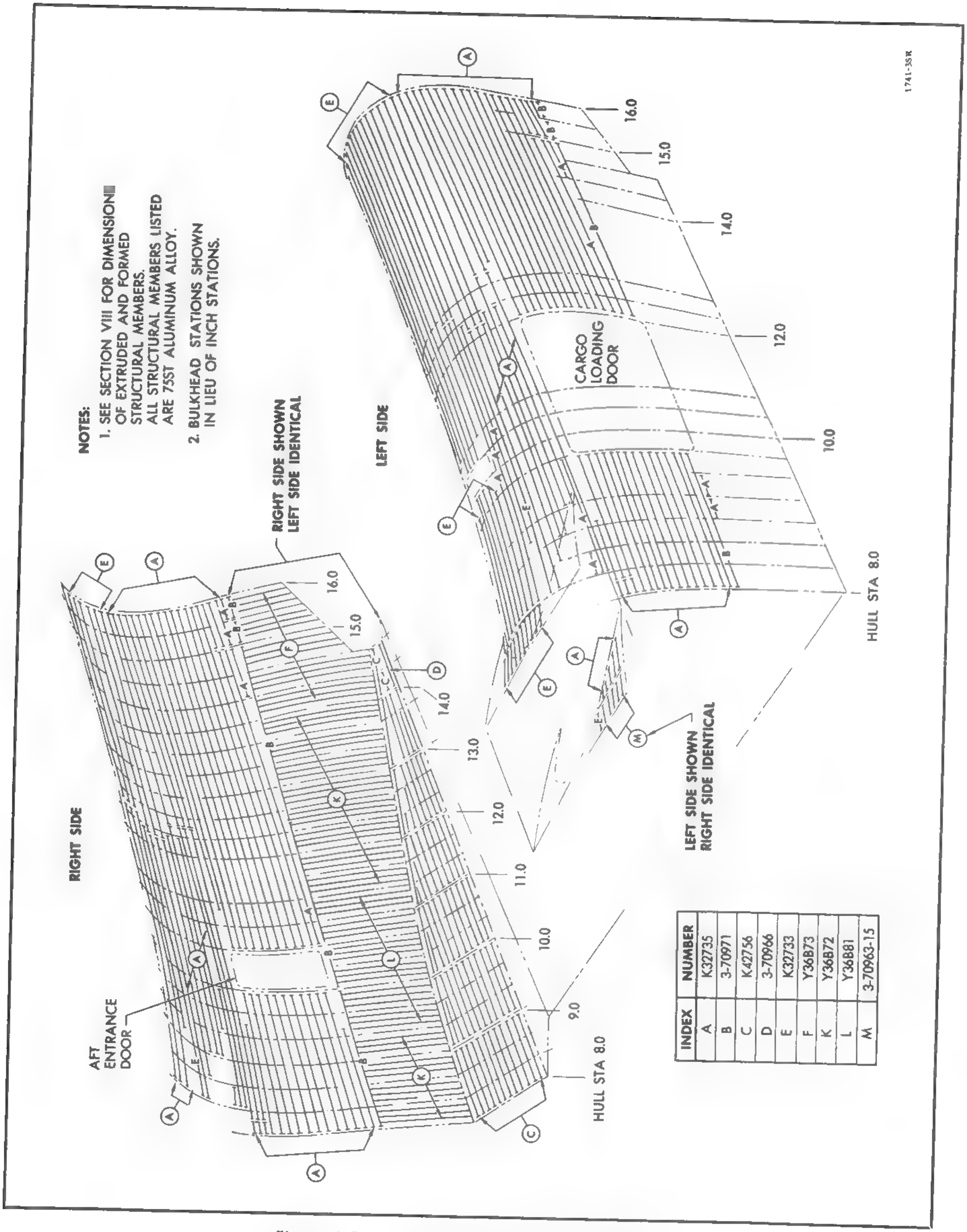


NOTES:

1. SEE SECTION VIII FOR DIMENSIONS OF EXTRUDED AND FORMED MEMBERS. ALL MEMBERS LISTED ARE 75ST ALUMINUM ALLOY.
2. BULKHEAD AND BELTFRAME STATIONS SHOWN IN LIEU OF INCH STATIONS.

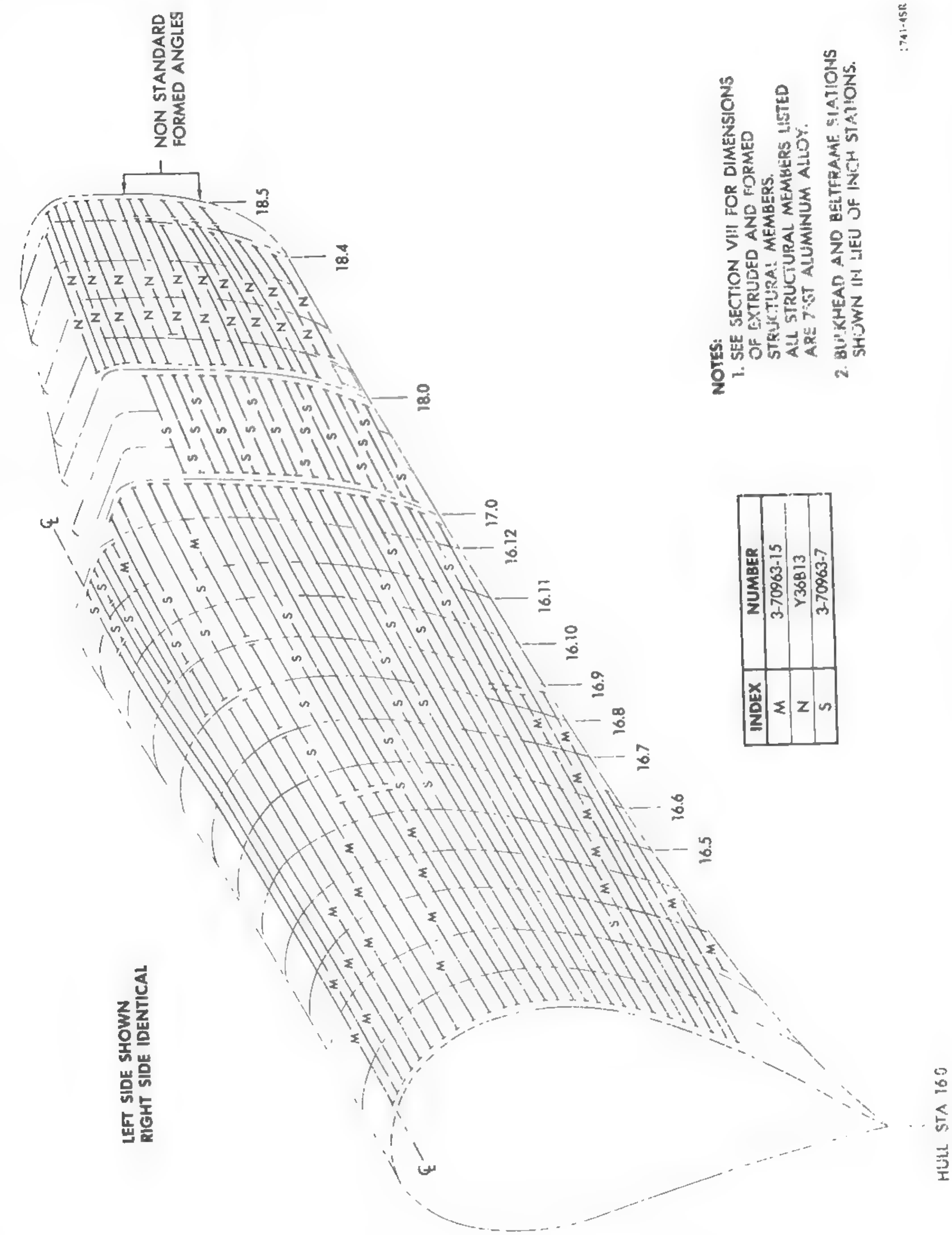
INDEX	NUMBER
A	K32735
B	3-70971
C	K42756
D	3-70966
E	K32733
F	Y36B73
H	Y36B71
J	Y36B80
T	FORMED CHANNEL .051 SHEET
U	FORMED ANGLE .051 SHEET

Figure 4-3. Hull Stringer Diagram (Sheet 3 of 5)



INDEX	NUMBER
A	K32735
B	3-70971
C	K42756
D	3-70966
E	K32733
F	Y36B73
K	Y36B72
L	Y36B81
M	3-70963-15

Figure 4-3. Hull Stringer Diagram (Sheet 4 of 5)



NOTES:

1. SEE SECTION VIII FOR DIMENSIONS OF EXTRUDED AND FORMED STRUCTURAL MEMBERS. ALL STRUCTURAL MEMBERS LISTED ARE 75ST ALUMINUM ALLOY.
2. BULKHEAD AND BELTFRAME STATIONS SHOWN IN LIEU OF INCH STATIONS.

INDEX	NUMBER
M	3-70963-15
N	Y36813
S	3-70963-7

Figure 4-3. Hull Stringer Diagram (Sheet 5 of 5)

4-15. GENERAL. "Z" extrusions are used almost exclusively above the floor level. They are attached to the bulkheads and frames by clips and rivets. The ends are connected by splice angles and rivets. Below floor level the stringers are flanged "T" extrusions and are attached to the frames by rivets and AN bolts. They terminate at each watertight bulkhead and the ends are equipped with dagger fittings. Their stresses are transmitted through the bulkheads by internal wrenching bolts. Corrosion resistant steel rivets are used to attach the dagger fittings to the stringers. Dagger fittings are made from extruded "T" members. 75ST aluminum alloy is used throughout.

4-16. NEGLIGIBLE DAMAGE. (Refer to paragraph 1-38.) Minor dents, nicks or scratches may be classed as negligible except adjacent to dagger fitting attachments.

4-17. DAMAGE REPAIRABLE BY PATCHING. Repair principles outlined in Section I and illustrated in Appendix II are applicable. Deeper nicks, holes or cracks may be repaired using a partial reinforcement as illustrated in figure B-4.

4-18. DAMAGE REPAIRABLE BY INSERTION. Repair principles as outlined in Section I are applicable. (See figure 4-6.)

4-19. DAMAGE NECESSITATING THE REPLACEMENT OF PARTS. Dagger fittings which are damaged beyond negligible limits must be replaced. They may be fabricated from the correct extruded "T." (See figure 4-6.)

4-20. LONGERONS. (See figure 4-3.)

4-21. GENERAL. Longerons are longitudinal members which carry and distribute loads received from transverse members. Locations are at the top of the hull, fore and aft of the wing attachment, at each side of door openings, and on each side at the floor level. They are of different cross sections and in general have the same importance and repair principles as stringers.

4-22. STIFFENERS. (See figure 4-3.)

4-23. GENERAL. These are vertical members bearing loads from the chine to the longeron at floor level. They are employed between bulkheads 1.0 and 16.0 and are roll formed "Z" members of 75ST alclad. There are two or three between each bulkhead or beltframe.

4-24. NEGLIGIBLE DAMAGE. (Refer to paragraph 1-38.) Due to the location of these members, negligible damage is rather unlikely except in connection with other more serious damage.

4-25. DAMAGE REPAIRABLE BY PATCHING. Repair principles outlined in Section I and illustrated in Appendix II are applicable.

4-26. DAMAGE REPAIRABLE BY INSERTION. Repair principles outlined in Section I are applicable.

4-27. DAMAGE NECESSITATING REPLACEMENT OF PARTS. Due to the short length and accessibility of these parts it will generally be more practical to replace than repair them.

4-28. CHINE AND KEEL. (See figure 4-2.)

4-29. CHINE. Chine angles are located at the junction of the hull bottom and the vertical side. They consist of formed angles of 75ST alclad. They are externally attached to the skin and frames from the bow to beltframe 14.2 and are double thickness aft of the step.

4-30. KEEL. The keel construction varies in type with station location. From the bow to bulkhead 4.0 it is constructed of formed members consisting of an external "v" and internal reinforcements. From bulkhead 4.0 to the step, beltframe 7.4, it is a special extruded shape (K-13687) installed internally but with a protruding flange. (Refer to Section VIII.) An abrasion channel is attached to the protruding flange for protection of the bottom skins. From the step to beltframe 14.2 the keel consists of an extruded keelson (K14087) installed internally with double external straps of 75ST alclad. (Refer to Section VIII.) Extruded keelsons are 24ST aluminum alloy.

4-31. NEGLIGIBLE DAMAGE. Keel and chine are designed as protection for the hull skin and structure as well as for structural strength. Nicks or gouges which do not reduce the cross sectional area of the outer chine angle or the outer keel strap aft of the step more than 10 percent may be classed as negligible. The external abrasion channel from bulkhead 4.0 to the step is not of structural importance and any damage to it may be ignored. Minor dents in keel or chine may be classed as negligible but should be investigated for cracks, loose rivets and possible leaks. Cracks must be repaired.

4-32. DAMAGE REPAIRABLE BY PATCHING. Repair principles outlined in Section I and illustrated in Appendix II are applicable.

4-33. DAMAGE REPAIRABLE BY INSERTION. Repair principles outlined in Section I are applicable. (See figure 4-6 for an example of insertion of keelson.)

4-34. DAMAGE NECESSITATING THE REPLACEMENT OF PARTS. Chine angles, external keel straps and angles as well as abrasion channel may be readily replaced if damaged at numerous places.

4-35. SKIN. (See figure 4-4.)

4-36. GENERAL. The skin of the hull is stressed throughout to varying degrees, the value of stress being indicated by the gage. Protruding head rivets and lap seams are used throughout in attaching the 75ST alclad sheet to provide maximum strength with minimum weight. Factors of water, air, and weathertightness must be considered in dealing with it. (Refer to paragraphs 4-3 to 4-5 for locations.)

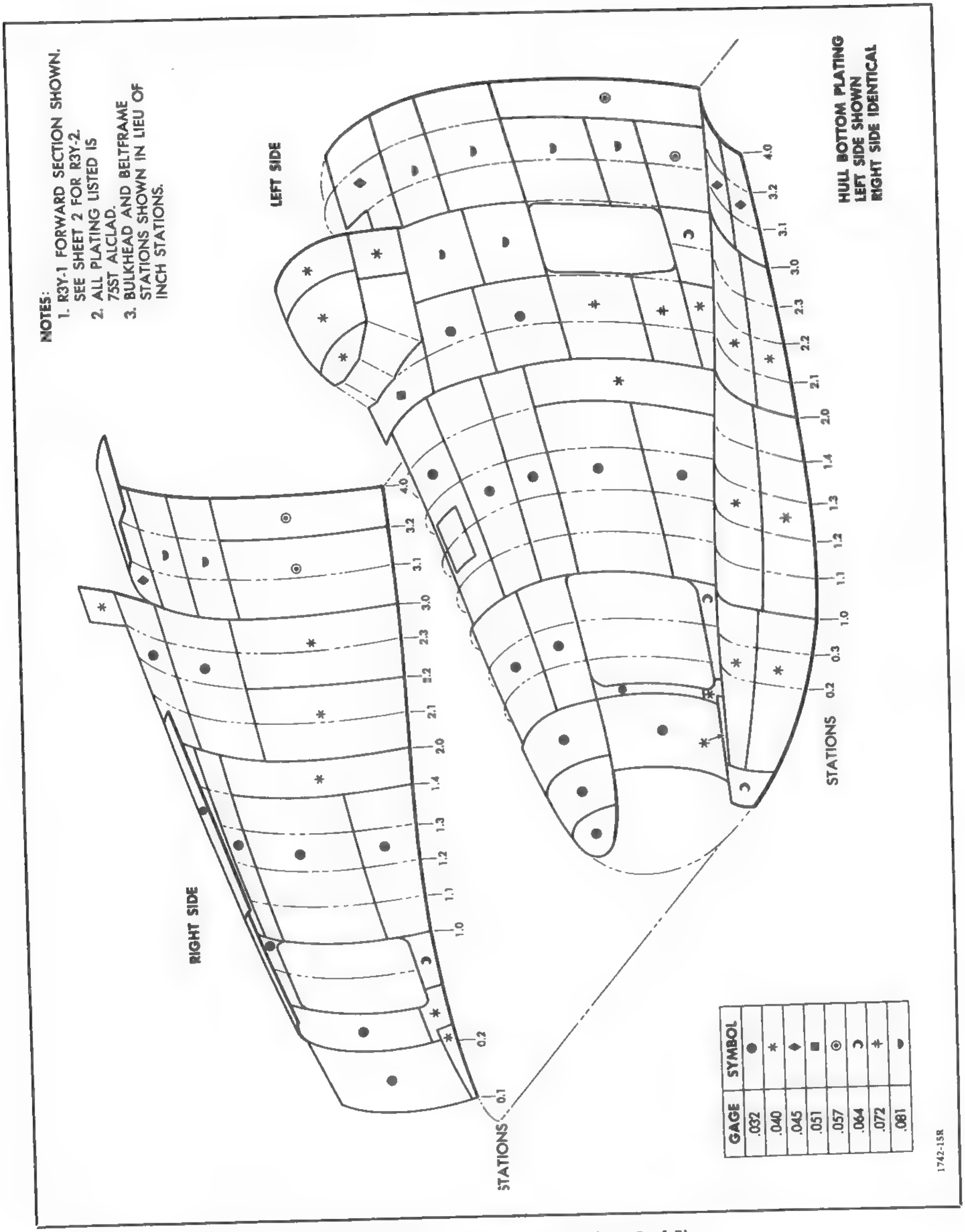
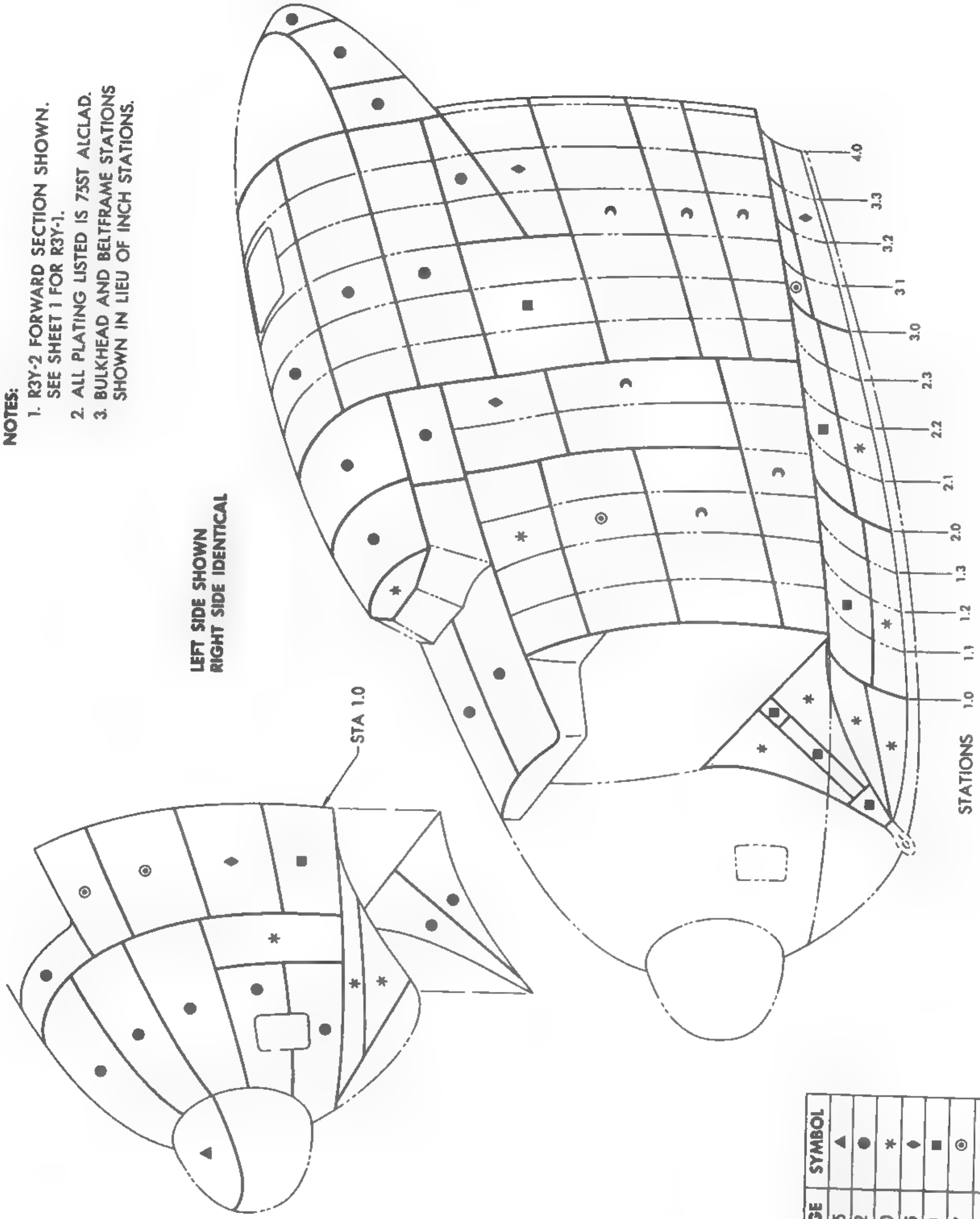


Figure 4-4. Hull Plating Diagram (Sheet 1 of 5)



NOTES:

1. R3Y-2 FORWARD SECTION SHOWN. SEE SHEET 1 FOR R3Y-1.
2. ALL PLATING LISTED IS 75ST ALCLAD.
3. BULKHEAD AND BELTFRAME STATIONS SHOWN IN LIEU OF INCH STATIONS.

GAGE	SYMBOL
.025	▲
.032	●
.040	*
.045	◆
.051	■
.057	◎
.064	◗

Figure 4-4. Hull Plating Diagram (Sheet 2 of 5)

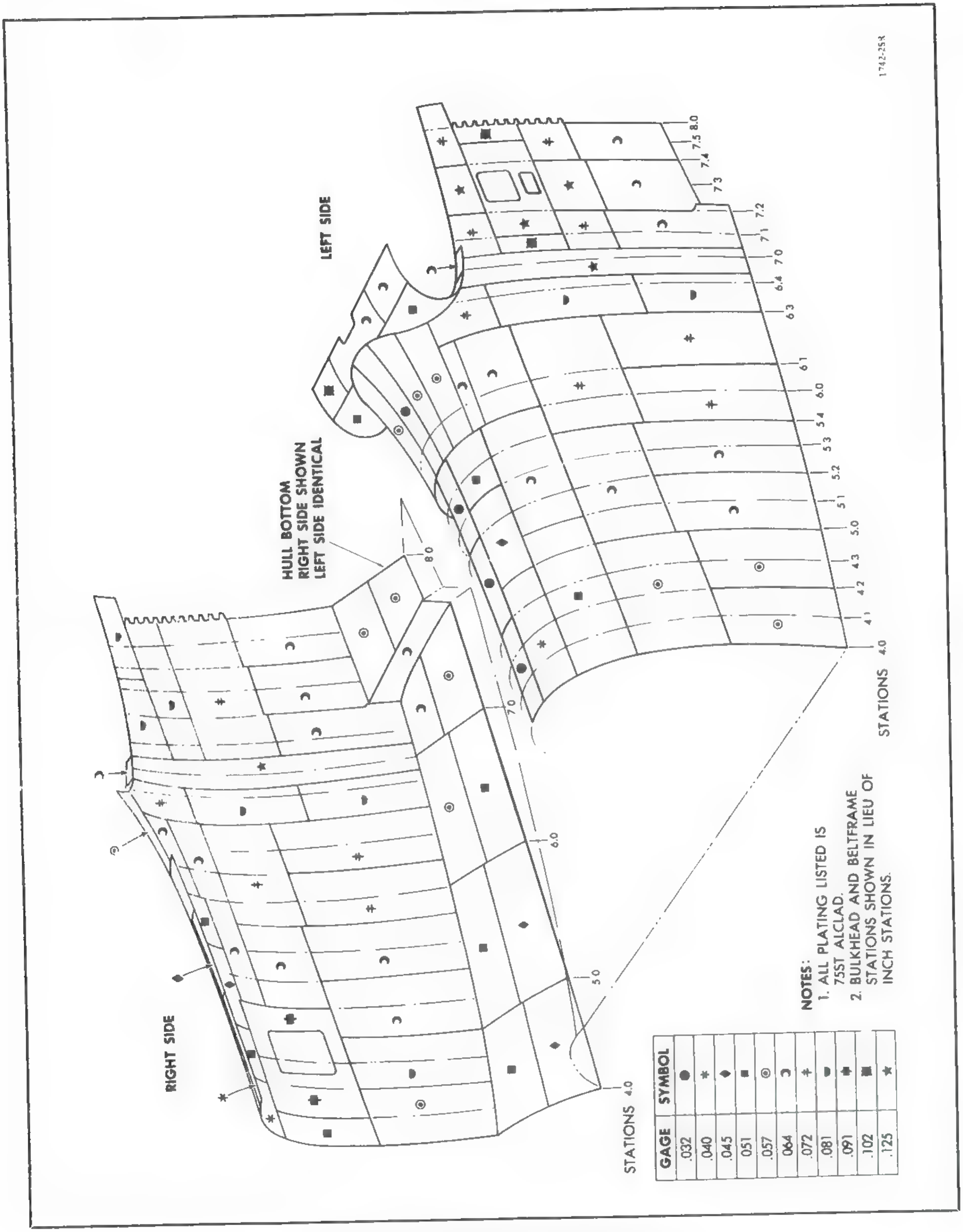


Figure 4-4. Hull Plating Diagram (Sheet 3 of 5)

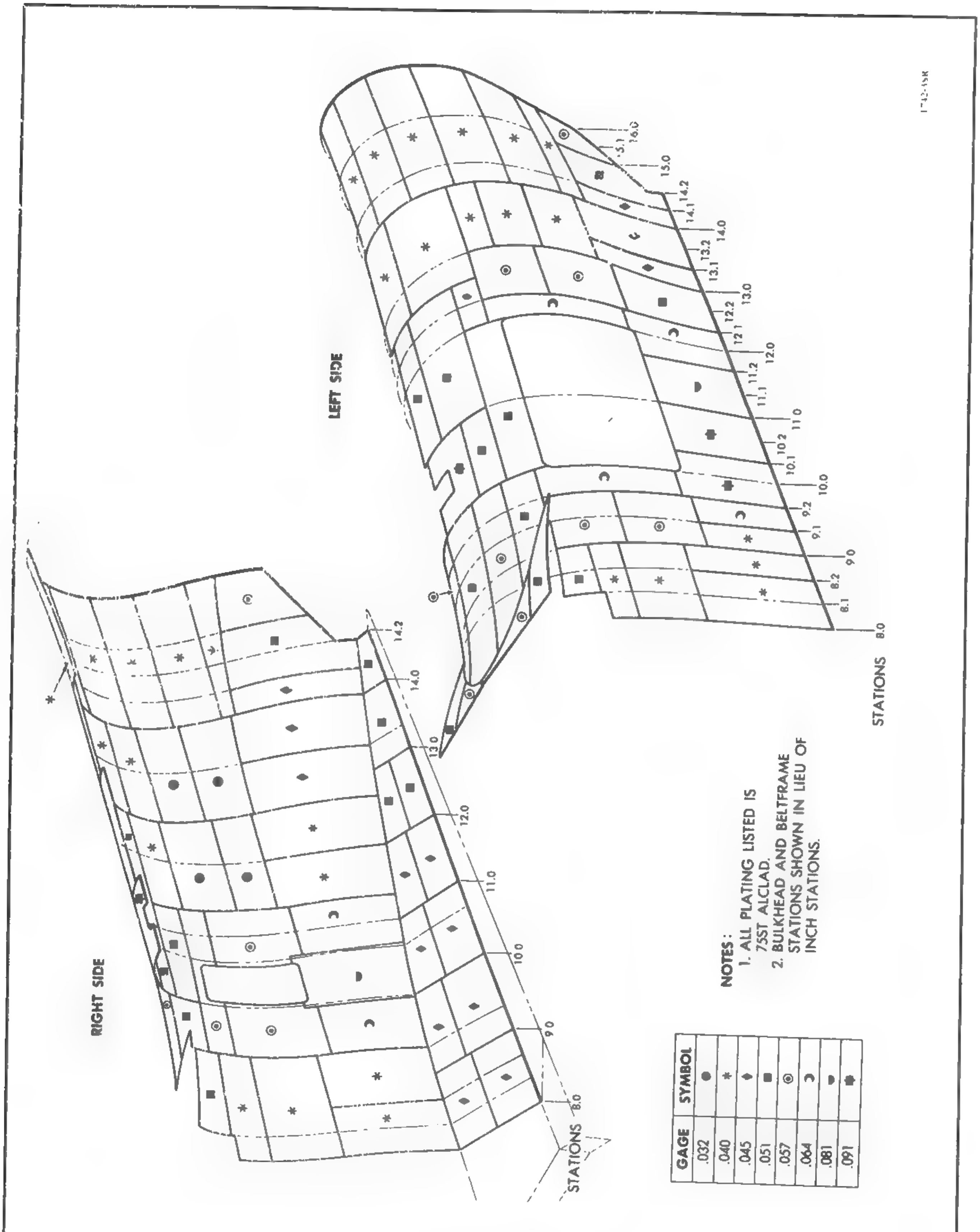
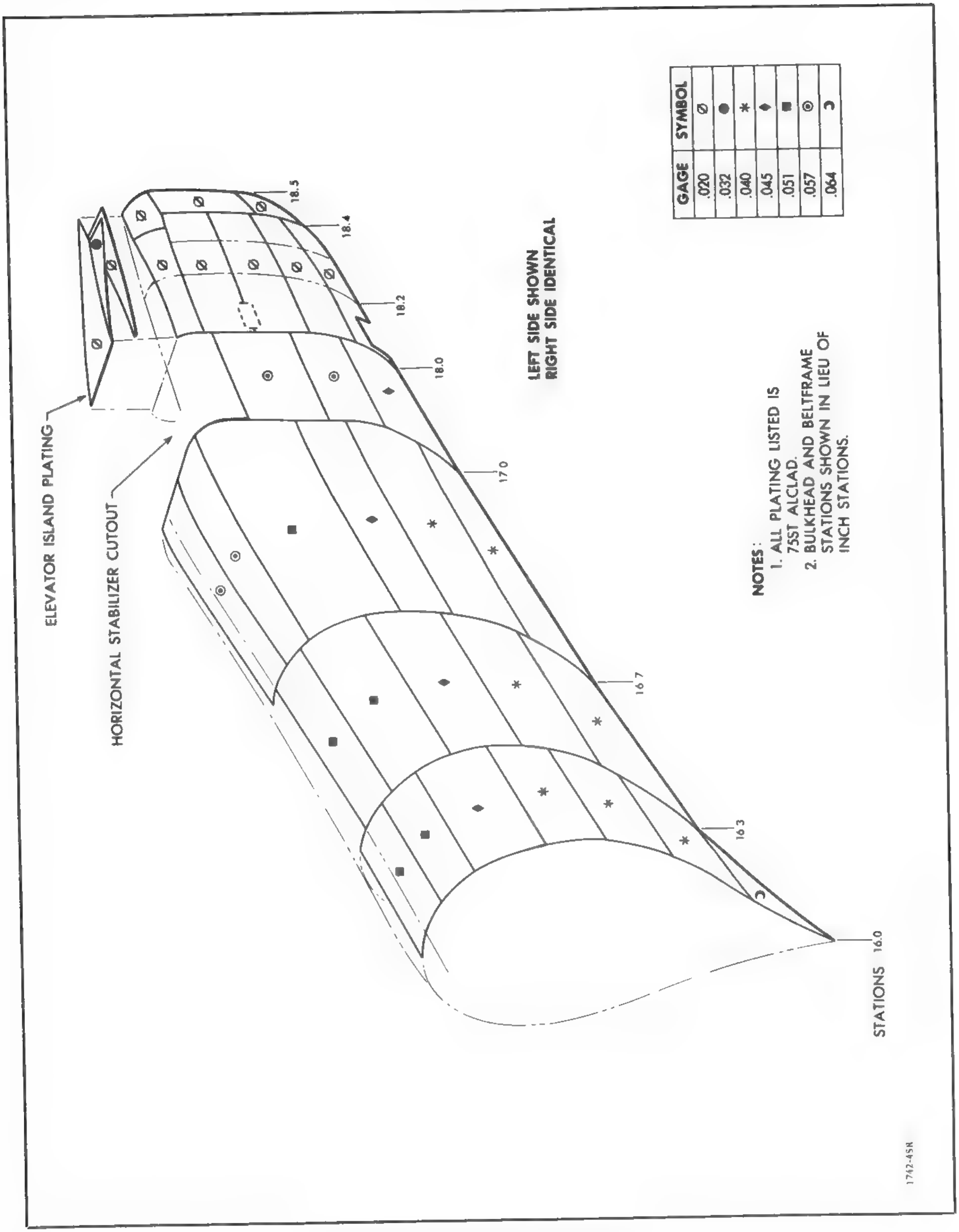


Figure 4-4. Hull Plating Diagram (Sheet 4 of 5)



GAGE	SYMBOL
.020	Ø
.032	●
.040	*
.045	♦
.051	■
.057	⊙
.064	ↄ

Figure 4-4. Hull Plating Diagram (Sheet 5 of 5)

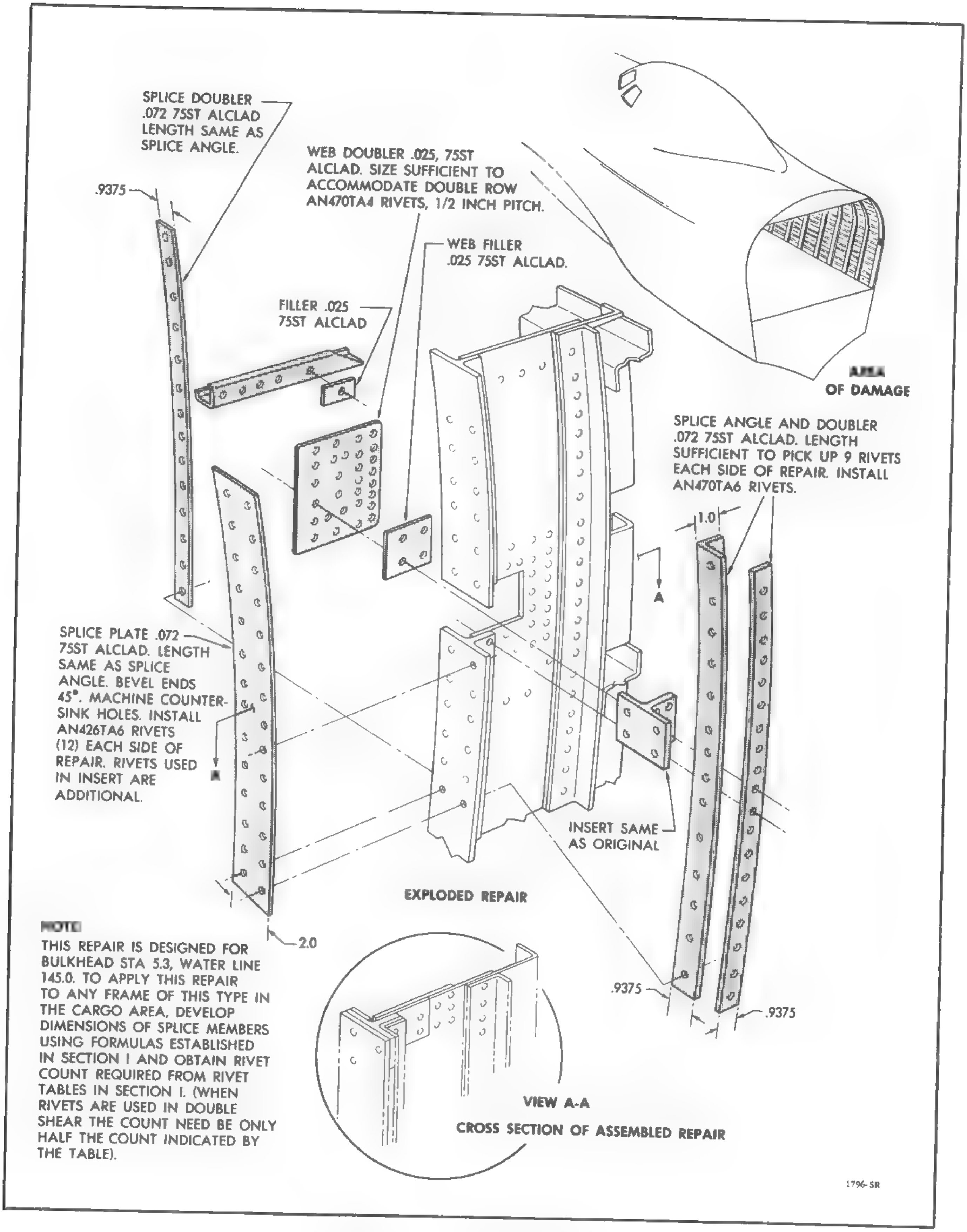


Figure 4-5. Hull Frame Repair

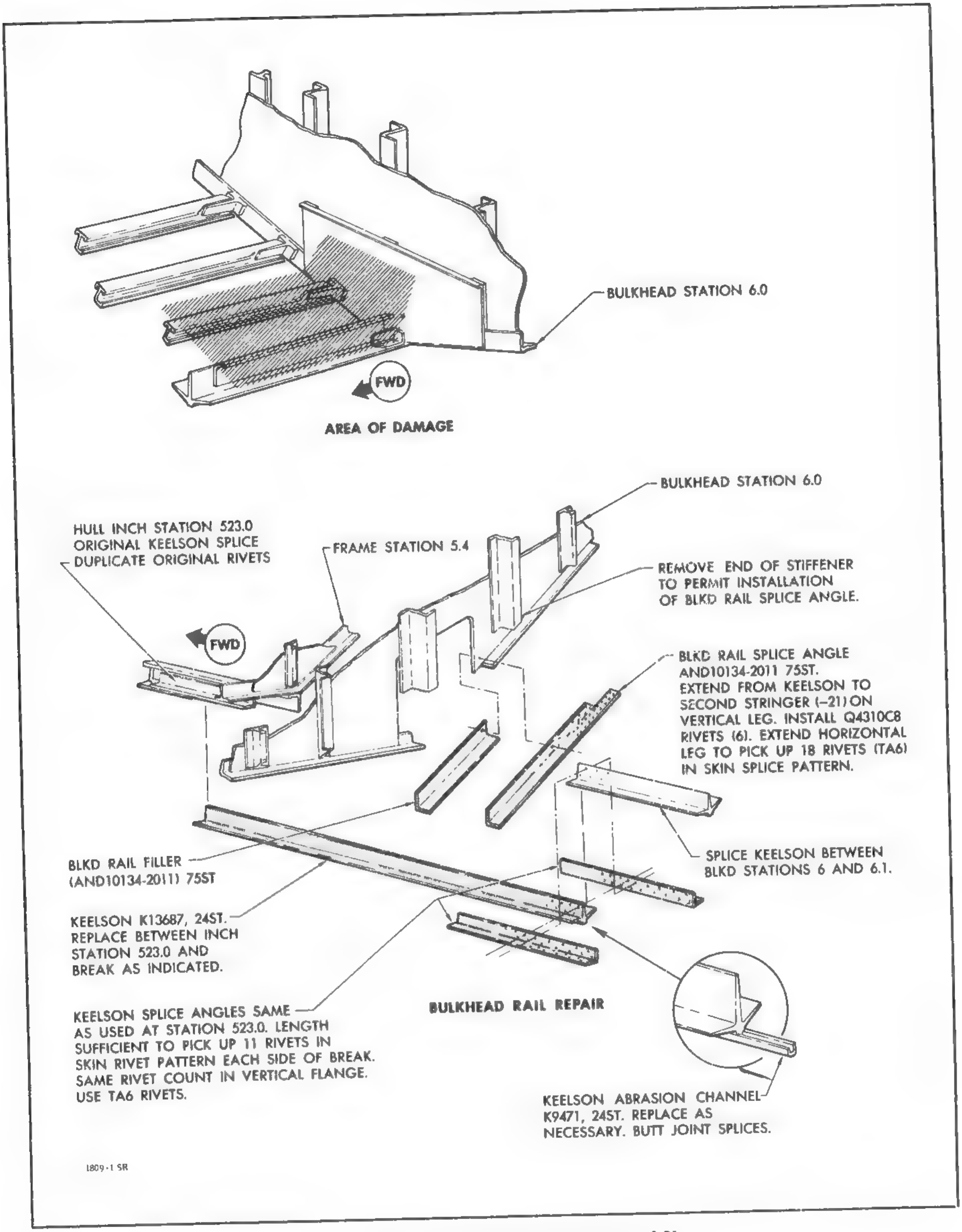


Figure 4-6. Hull Bottom Repair (Sheet 1 of 3)

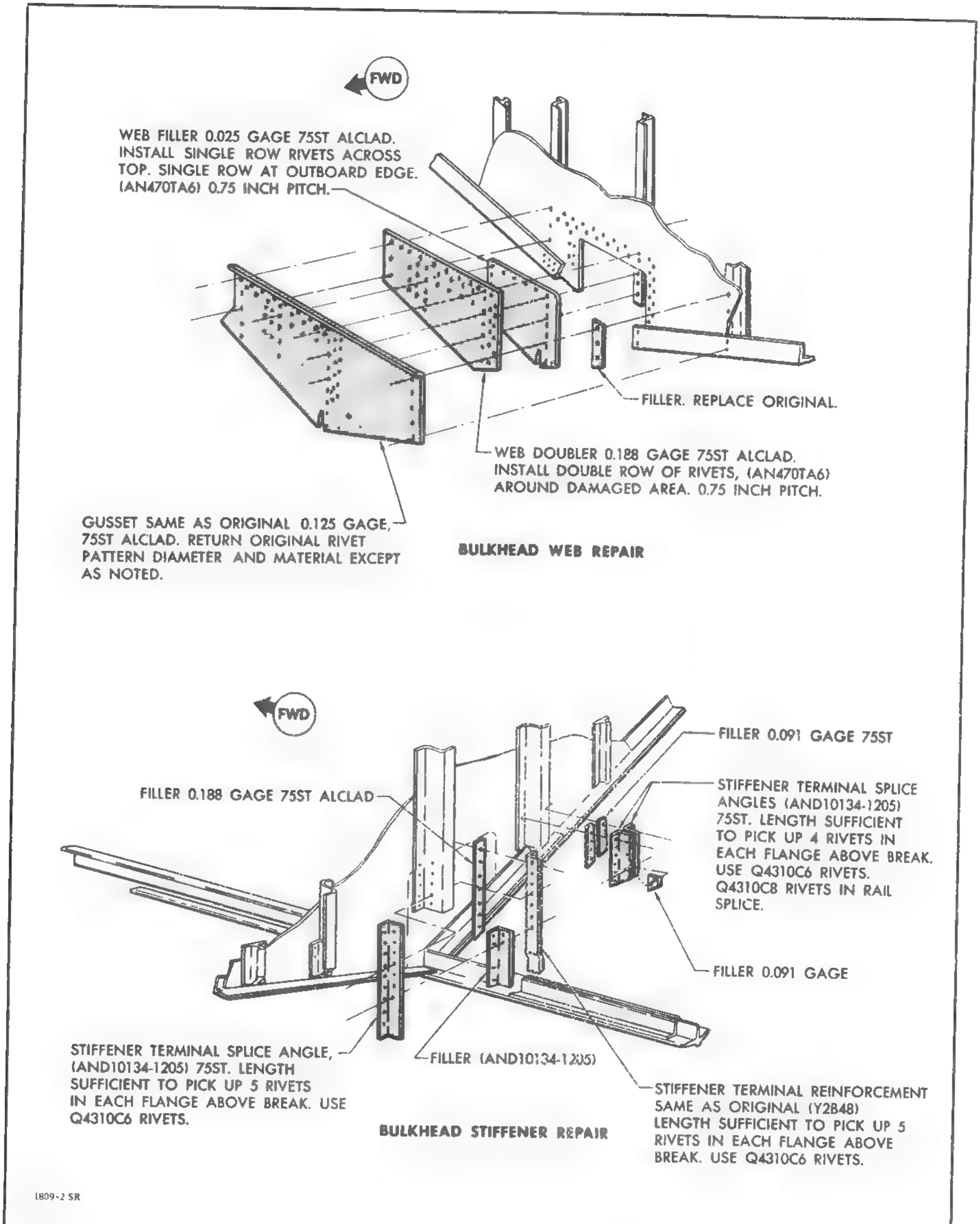
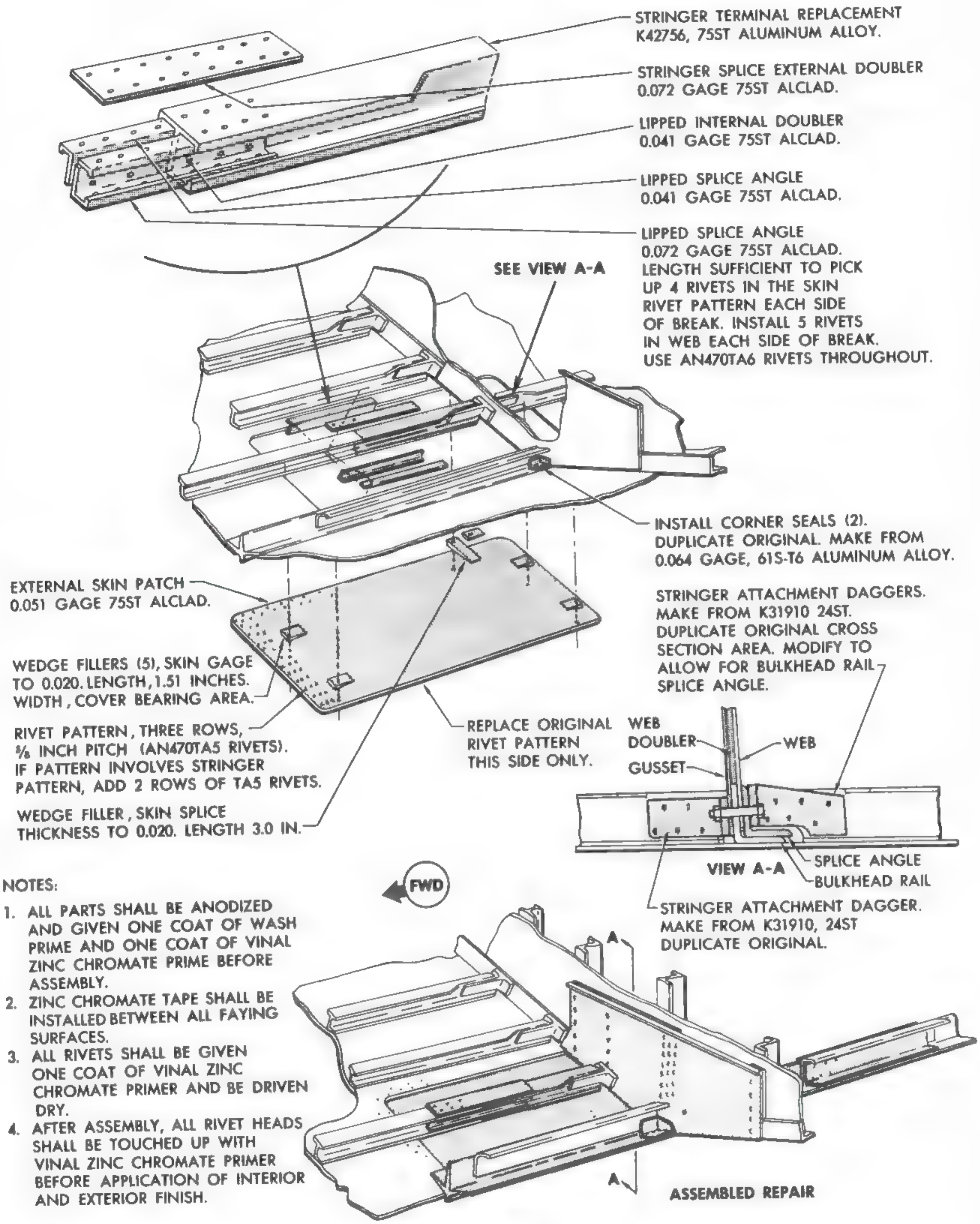


Figure 4-6. Hull Bottom Repair (Sheet 2 of 3)



NOTES:

1. ALL PARTS SHALL BE ANODIZED AND GIVEN ONE COAT OF WASH PRIME AND ONE COAT OF VINAL ZINC CHROMATE PRIME BEFORE ASSEMBLY.
2. ZINC CHROMATE TAPE SHALL BE INSTALLED BETWEEN ALL FAYING SURFACES.
3. ALL RIVETS SHALL BE GIVEN ONE COAT OF VINAL ZINC CHROMATE PRIMER AND BE DRIVEN DRY.
4. AFTER ASSEMBLY, ALL RIVET HEADS SHALL BE TOUCHED UP WITH VINAL ZINC CHROMATE PRIMER BEFORE APPLICATION OF INTERIOR AND EXTERIOR FINISH.

STRINGER AND SKIN REPAIR

1809-3 SR

Figure 4-6. Hull Bottom Repair (Sheet 3 of 3)

4-37. NEGLIGIBLE DAMAGE. (Refer to paragraph 1-38.) Minor dents, scratches and nicks may be classed as negligible. Small holes in the aft unpressurized section may be classed negligible from a structural viewpoint but weathertightness should be considered. Small air leaks may be sealed in the pressurized area above the cargo floor level by internal application of sealer, EC801.

4-38. DAMAGE REPAIRABLE BY PATCHING. Repair principles outlined in Section I and illustrated in Appendix II are applicable. (See figure 4-6 for a hull bottom skin repair.) External patches with protruding head rivets are recommended. All patches must be installed with zinc chromate tape between faying surfaces.

4-39. DAMAGE REPAIRABLE BY INSERTION. Repair principles outlined in Section I are applicable.

4-40. DAMAGE NECESSITATING REPLACEMENT OF PARTS. Damaged panels of skin may be removed to facilitate structural repairs. In this case it would be desirable to replace the damaged skin.

4-41. FLOORING.

4-42. GENERAL. The flooring is of several types. That in the bow anchor compartment (R3Y-1 only), pilots' compartment and lavatory between bulkhead 15.0 and 16.0 are 75ST alclad. The floor from bulkhead station 1.0 to 4.0 in the R3Y-1 are of honeycomb core construction. The cargo compartment floor between bulkhead 4.0 and 15.0 of the R3Y-1 and bulkhead 1.0 and 15.0 of the R3Y-2 is constructed of magnesium extrusions. A walkaway of corrugated 75ST alclad sheet is provided aft of bulkhead 16.0.

4-43. 75ST ALCLAD FLOORING. The floor forward of bulkhead 1.0 is stressed, therefore, conventional weathertight skin repairs are required. Flush patches with flush riveting are desirable. The floor in the pilots' compartment consists of removable panels of light alclad riveted to frames and is not stressed except for live loads. Conventional skin repairs or replacement of entire panels is recommended. The floor in the lavatory is part of the structure and is stressed by pressurization. Repairs must meet structural and airtight requirements. Holes, cracks, or loose rivets are never negligible. The walkaway aft of bulkhead 16.0 is not stressed except for live loads of traffic. Repairs may be of conventional type or panels may be replaced.

4-44. HONEYCOMB CORE FLOORING. This flooring is installed in panels and has little structural importance. All panels are 0.63 inch thick. The honeycomb core material is 3S aluminum. The top and bottom faces vary in material and gage. That in the navigator's compartment of the R3Y-1 is 0.020 gage, 75ST alclad on both surfaces. Entrance compartment panels are 0.020 gage, 24ST alclad on both surfaces. Flight engineer's compartment panels are 0.020 gage, 24ST alclad on the upper surface and 0.032 gage, 24ST alclad on the lower. Holes of under one inch in diameter in the upper surface only of these panels may be repaired by filling with putty, Narmco 3119. (See figure 4-7 for a larger repair.) If damaged beyond this extent, the panel should be replaced.

4-45. CARGO COMPARTMENT FLOOR. This floor is built up of special magnesium alloy extrusions (3-70508, 3-70530 and 3-70531). (See figure 8-13.) They are connected at the edges and to the hull frame and bulkheads by 56S(B) aluminum alloy rivets. Fittings are provided for attachment of seats, litters, and for cargo tiedown. In addition to providing a rigid floor to resist heavy concentrated cargo loads it also serves as a web through the center of the hull and carries structural shear loads. No repairs have been designed and repairs of a permanent nature would consist of replacing damaged sections. Damaged tiedown and seat attachment fittings should be replaced.

4-46. FLOOR COVERING. The cargo floor is protected against abrasion by a covering of Generco, a phenolic type material. It is cemented to the floor with adhesive, EC833, at room temperature. Only sufficient pressure is required to insure full contact. Damaged panels may be removed by progressive loosening from an edge using a petroleum naptha. The floor covering between bulkheads 1.0 and 4.0 (R3Y-1) and on the flight deck of the R3Y-2 is Duracote. This material has a fiberglas backing with a vinyl surface. It is installed over 0.0125 inch felt and attached at edges. Replacement is recommended as no satisfactory adhesive for repair is known at this time.

4-47. Partitions at bulkheads 4.0 and 15.0 of the R3Y-1 are of honeycomb core fiberglas panels. These parts are not stressed. (Refer to paragraph 1-75 for plastic repair reference.) These panels have no structural significance and any convenient repair is satisfactory.

4-48. DOORS.

4-49. GENERAL. All doors in walls of the hull between bulkheads 1.0 (R3Y-1 only) and 16.0, including the doors in these bulkheads, are stressed when the area is pressurized. All doors in the R3Y-2 are in this category. Any repair to skin must meet airtight requirements. These doors are equipped with rubber diaphragm type seals. (See figure 4-8 for a repair involving a door seal.)

4-50. BOW DOOR. (See figure 4-9.) This unit constitutes the entire enclosure at the forward end of the R3Y-2 cargo compartment. It is subject to stresses of pressurization throughout. A canted, watertight bulkhead is installed at the rear lower portion of the door to match the canted bulkhead on the hull. Repairs to this bulkhead and the door skin below waterline 99 inches must be watertight. The main structure of the door consists of beltframes and stringers similar to those of the hull structure. Radar equipment is installed in and protrudes from the forward portion of the door and is

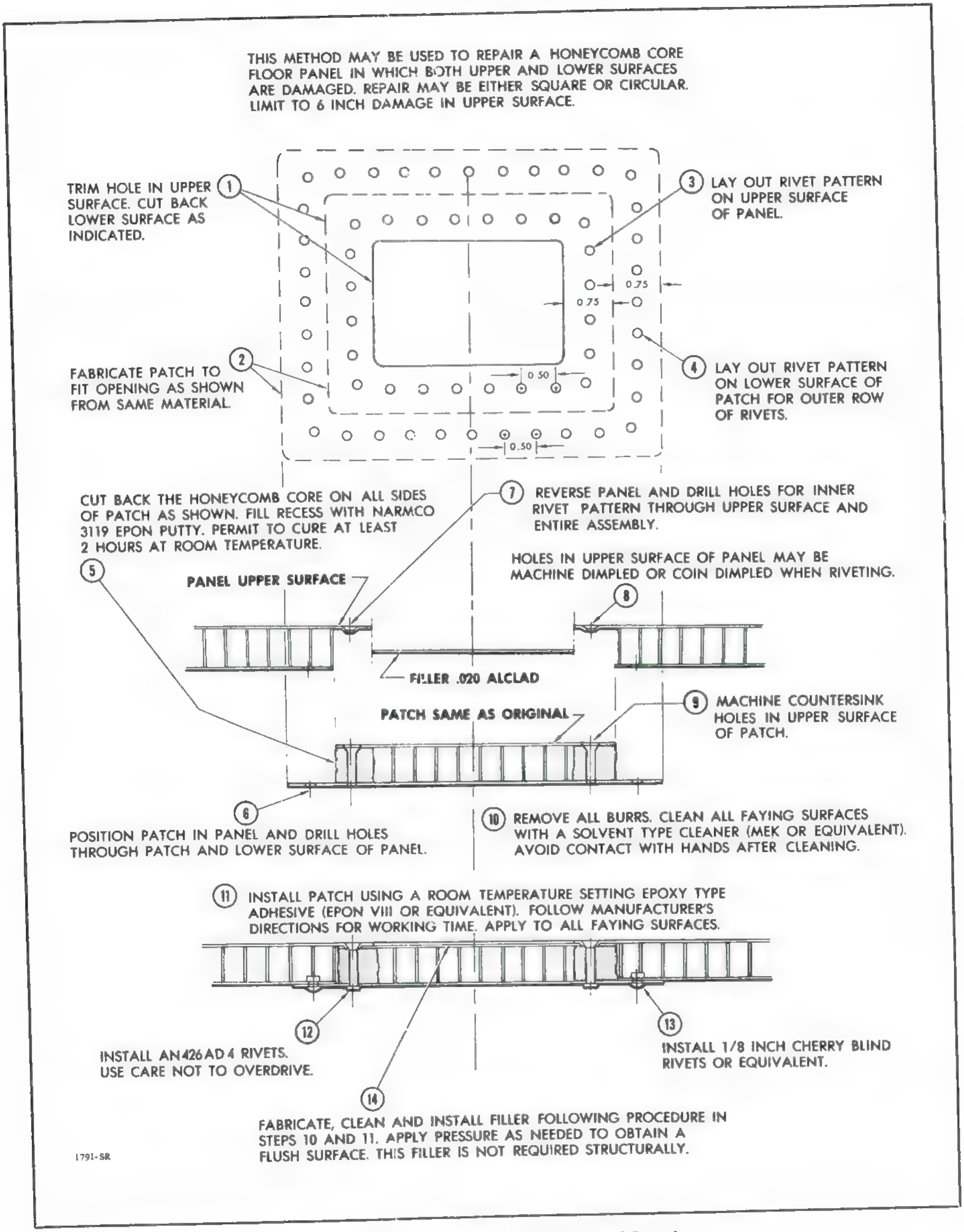


Figure 4-7. Sandwich Type Floor Panel Repair

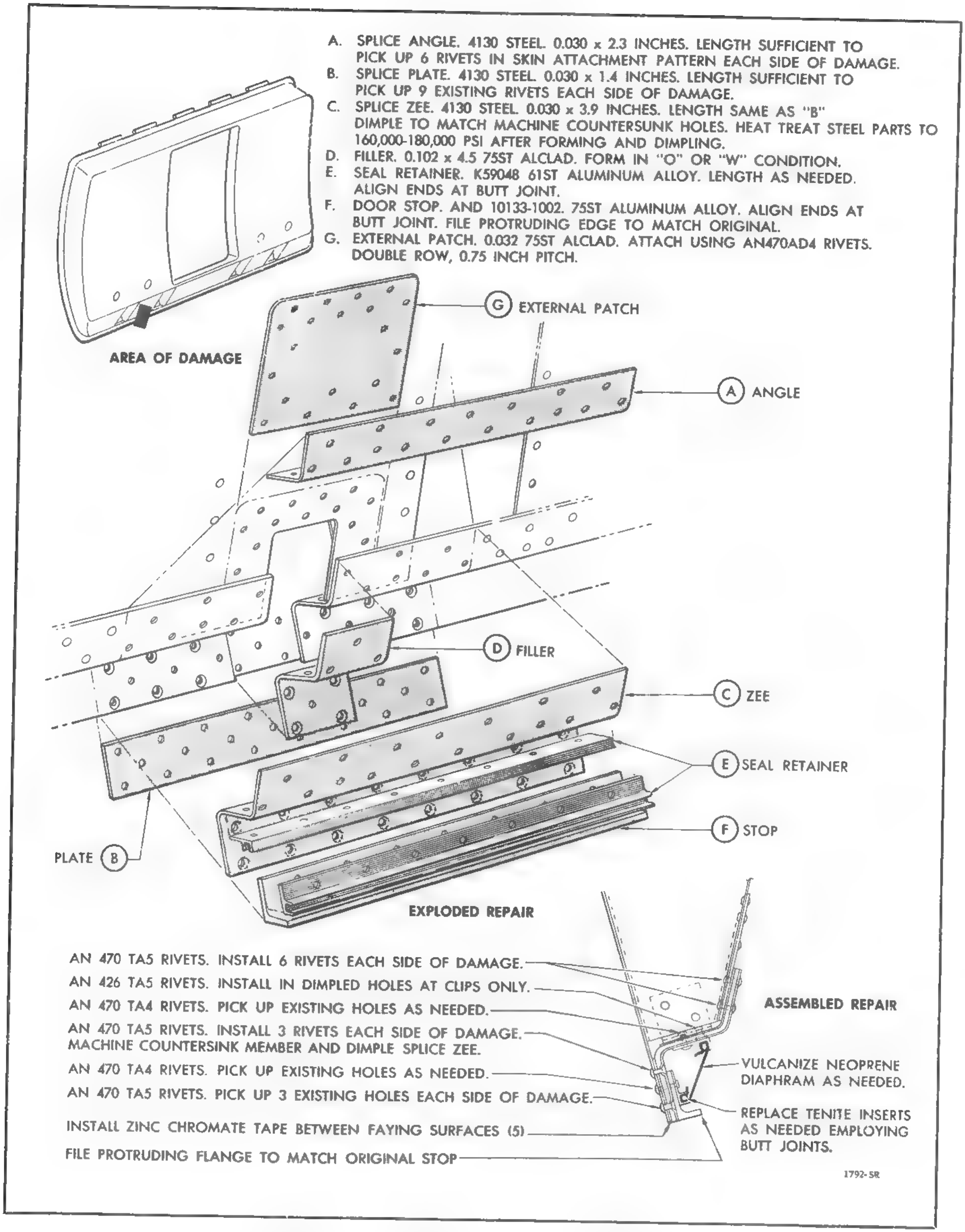


Figure 4-8. Side Cargo Door Frame and Seal Repair

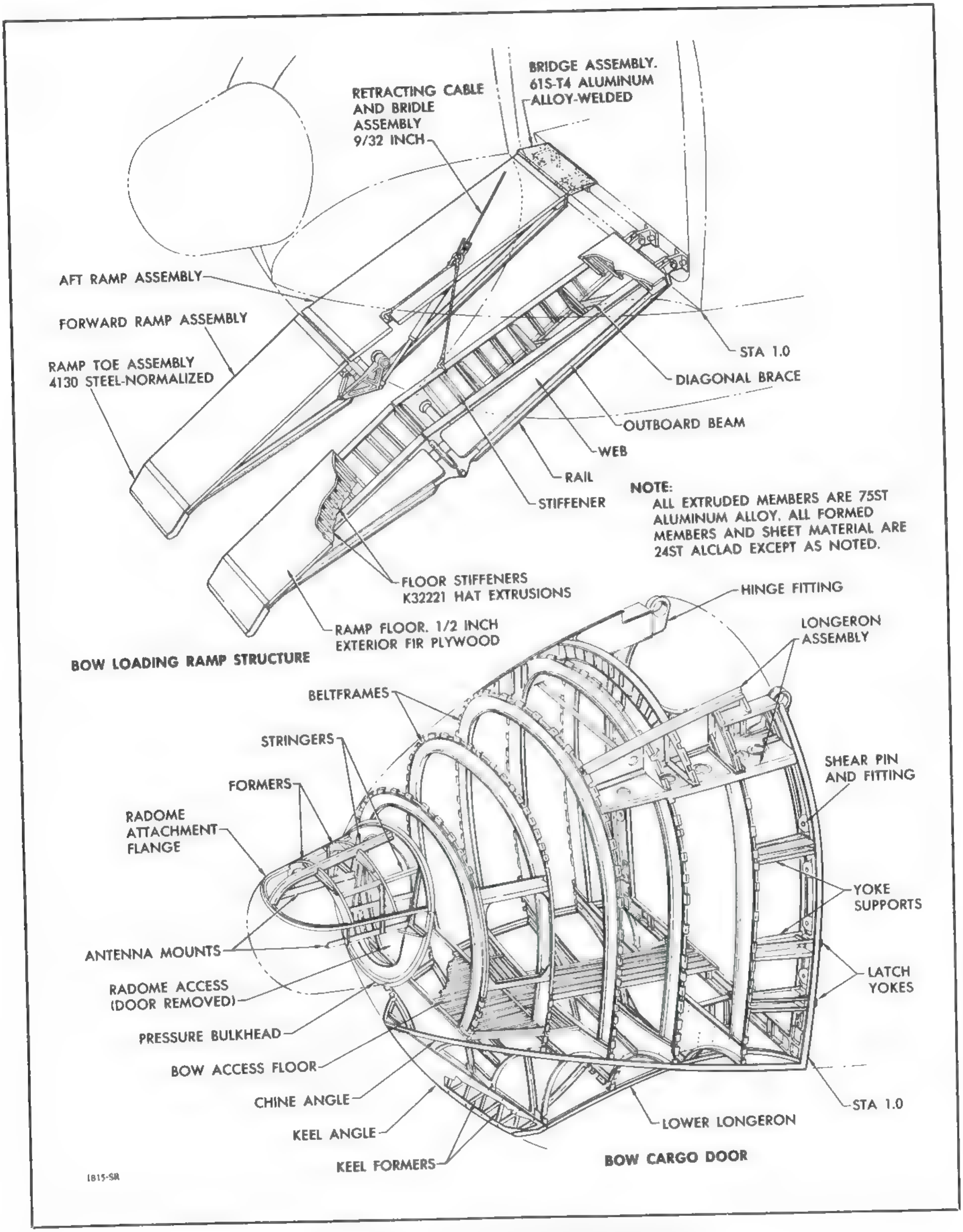


Figure 4-9. Bow Cargo Door and Loading Ramp Structure

covered by a dome shaped fiberglas shield. (Refer to paragraph 4.52.) A walkaway is provided to give access to the radar installation when the bow door is closed. Its construction is similar to that of the walkaway aft of bulkhead 16.0. Repairs to the door structure and skin are similar to those prescribed for the hull. Attachment and locking parts and alignment pins damaged beyond negligible limits must be replaced. Any structural repair at the edge of the door or hull opening must return the integrity of the air seal. Sealing is accomplished by inflation of a pneumatic seal ring nested in a channel riveted to the door. This seal ring is not repairable. The channel (3-78966) in which it is nested may be repaired by insertion of new lengths of the original extrusion. (Refer to Section VIII.) Attach, using DD rivets and picking up original rivet pattern. Join ends with butt joints, 0.0 to 0.040 inch end clearance.

4-51. BOW RAMP. (See figure 4-9.) The ramp consists of two inter-connected runways hinged to the hull at floor level of bulkhead 1.0. These runways are hinged at the center and stow in a vertical position forward of bulkhead 1.0 to permit closure of the bow door. Each runway consists of two spars. Each spar is built up of a sheet stock web with extruded "T" rails and stiffeners. 75ST aluminum alloy is used throughout. These runways are faced with readily replaceable plywood panels. The ramp is not subject to flight loads and any damage might be classed negligible which would not interfere with bow door closure. In case of serious damage to the ramp, the hull structure in attachment area should be investigated for transmitted damage before flight. Repair of the ramp should follow principles outlined in Section I and illustrated in Appendix II. (See figure 4-10 for a spar rail and web repair.)

4-52. BOW FIBERGLAS RADAR COVER.

4-53. GENERAL. Radar equipment installed in the bow is covered by a fiberglas fairing. This fairing is of honeycomb core construction and is molded to carry out the contour of the hull skin. It is not a structural member and is not pressurized.

4-54. REPAIR. Minor scratches are the only damage which may be permitted. Cracks, nicks, and holes will interfere with radar reception and must be repaired. Cemented inserts of the same material which maintain the original contour of the unit are the only type of repair which may be made. (Refer to paragraph 1-75 for reference to repair information.)

NOTE

Do not refinish this unit with ordinary exterior finish. A semi-conductive finish is applied and should be supervised by an electronics technician.

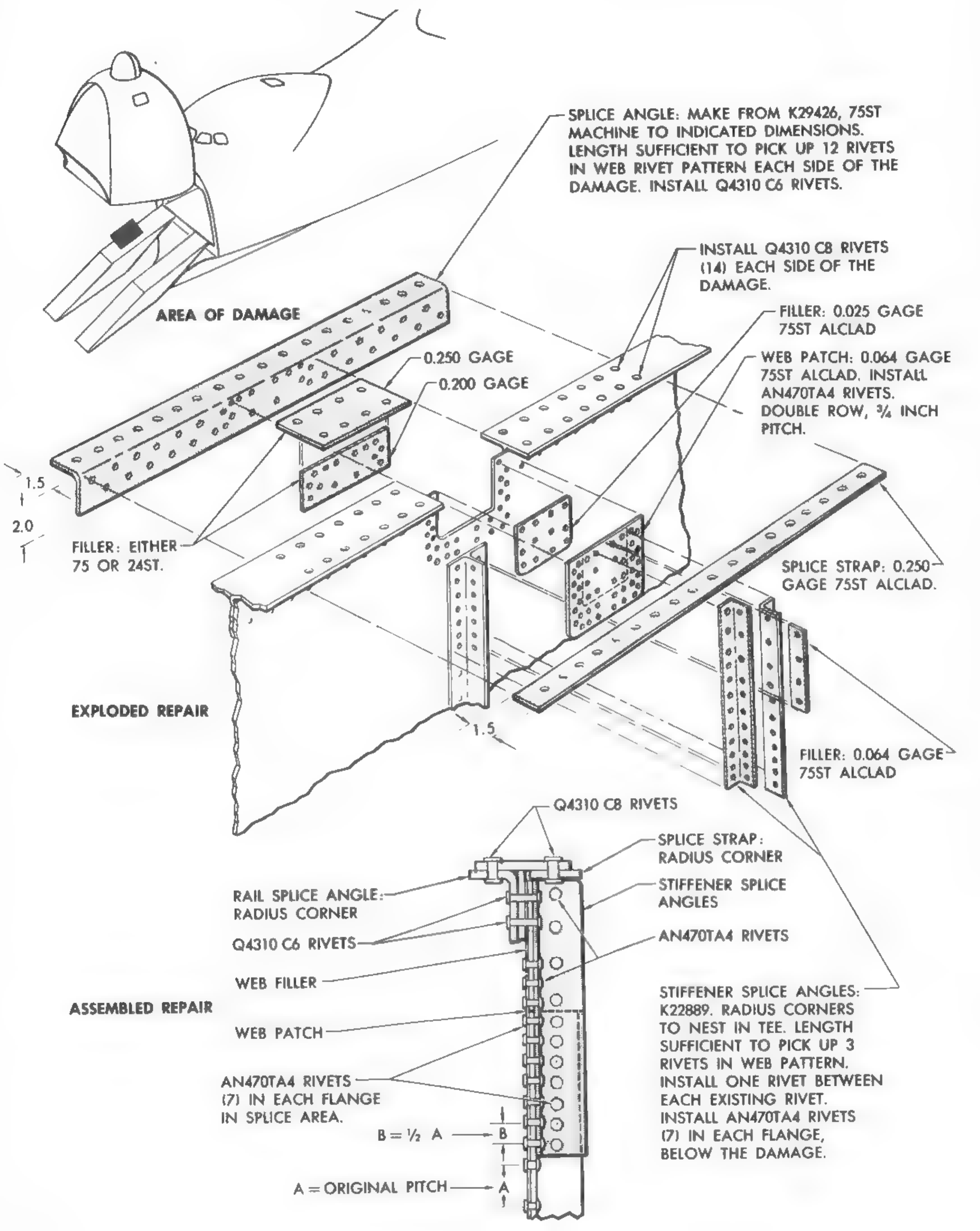


Figure 4-10. Bow Loading Ramp Repair

SECTION V

ALIGHTING GEAR

NOTE

An alighting gear is not installed on this airplane. A beaching cradle, SE0502, is used to maneuver the airplane on the ground; refer to NAVAER 19-15AA-501.

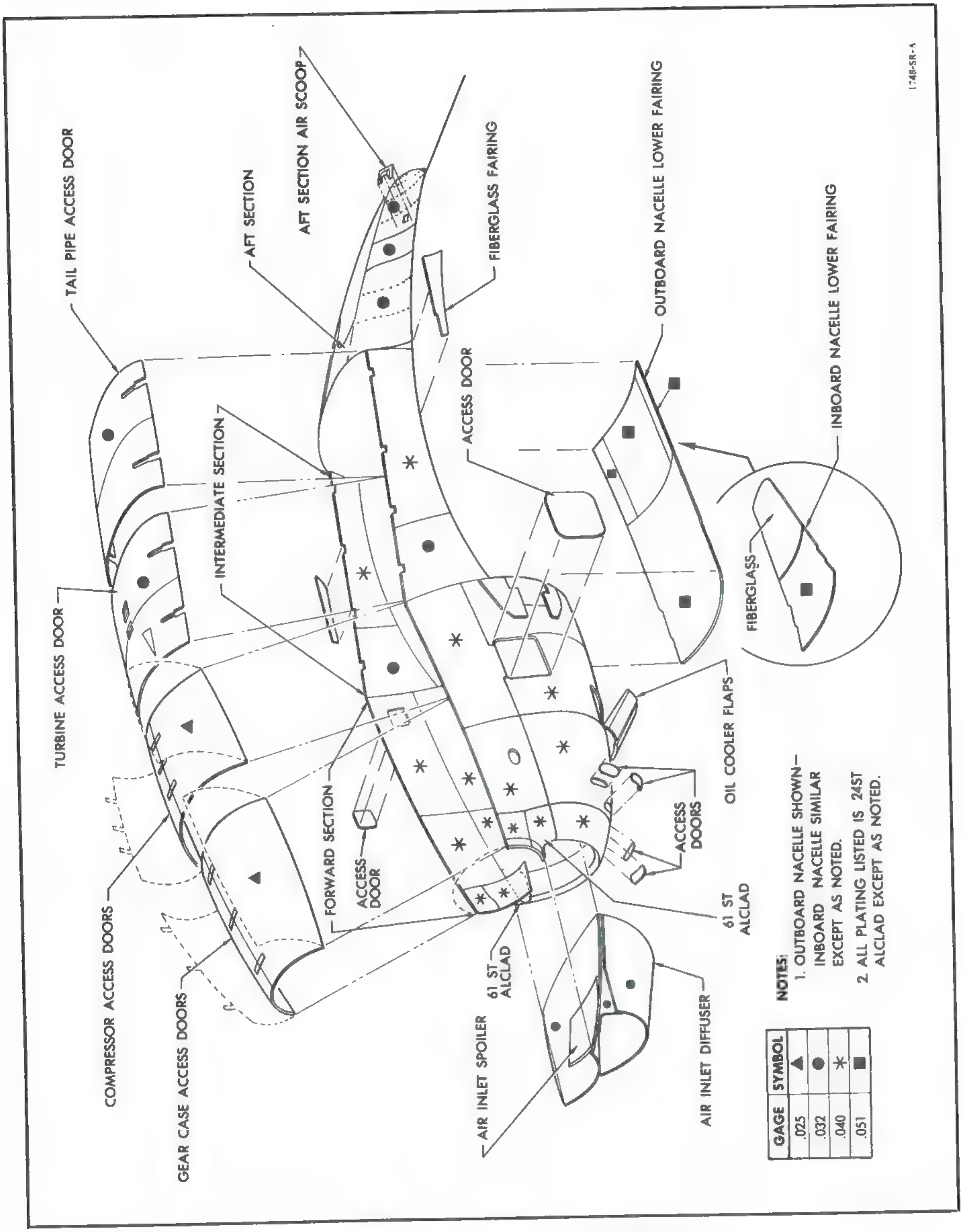


Figure 6-1. Nacelle Components and Plating

SECTION VI

NACELLE GROUP

6-1. NACELLES.

6-2. GENERAL. Four nacelles are attached to the wing interspar structure by bolts and rivets. They are centered at wing rib stations 6 and 12, left and right. The structure of each consists of a nose, intermediate, and aft section. It serves as a support and enclosure for the power plant and its attachments and accessories. (See figures 6-1 and 6-2 for component parts, construction and material, and figure 6-3 for station diagram.) Inboard and outboard nacelle forward sections are identical. Intermediate and aft sections are similar, differing in dimensions only.

6-3. NACELLE NOSE SECTION.

6-4. GENERAL. The nose section houses the power plant compressor section and reduction gear assemblies, and accessories. The oil cooler and oil tank are also located in this section. The forward part of the nose section contains the air inlet, diffuser flap, and plenum divider for the engines. Two pairs of access doors are hinged at the upper longerons and when open, the longerons serve as work platforms for removal and installation of the power plants. A tunnel of corrosion resistant steel is incorporated in the aft lower portion of the nose section and serves as a part of the thermal anti-ice system. It is connected at each side of the nacelle to the "D" duct of the adjacent wing leading edge. A side access door provides access to the plenum chamber and serves as a work platform.

6-5. CONSTRUCTION. The nose section is semi-monocoque construction consisting of frames, longerons and stressed skin. The frames are formed, flanged, and reinforced members. The upper longerons are heavy formed channels. The lower longeron is a heavy, built-up beam. These three longerons are the chief members bearing longitudinal loads to the wing interspar structure. The stressed skin is dimpled and flush riveted. Upper access doors consist of formed channel edges and stamped contoured frames. The outer skin is dimpled and flush riveted while the inner skin is attached with universal head rivets. Frames, longerons, and stiffeners are 75ST alclad. Skin is 24ST alclad throughout except as noted in figure 6-1. A diagonal truss is installed from the wing spar at the left side of the nacelle to the right side of the nacelle frame at inch station 90.0. It is 4130 steel tubing, heat treated to 120,000 psi. The power plant is supported at the rear by a fork assembly attached to the front spar. It is fabricated of 4130 steel, heat treated to 145,000 to 170,000 psi. The power plant is supported at the gear case by a 14ST aluminum forged fitting attached to each top longeron and adjacent frames.

6-6. NEGLIGIBLE DAMAGE. (Refer to paragraph 1-38.) Minor dents, scratches and nicks may be classed as negligible except as follows: Engine mounting fittings and longerons adjacent to these fittings, longerons at splices, diagonal truss tube, and the rear engine mount fork assembly. Fatigue cracks may be stop drilled, pending repair, in access doors only. Small holes may be permitted in access door skins, inner and outer, pending repair. Cracks or holes in the thermal anti-ice tunnel must be repaired at once.

6-7. DAMAGE REPAIRABLE BY PATCHING. Repair principles as outlined in Section I and illustrated in Appendix II are applicable. (See figure 6-4 for an upper longeron repair.) Flush type skin patches, dimpled and flush riveted, are desirable throughout and required at the air inlet and in the diffuser liner. Accessory door inner and outer skin patches may be applied using cherry blind rivets. Holes in the thermal anti-ice tunnel may be repaired using a 0.020 gage corrosion resistant steel patch and 0.093 inch corrosion resistant steel rivets, double row and 0.5 inch pitch.

6-8. DAMAGE REPAIRABLE BY INSERTION. Repair principles outlined in Section I are applicable.

6-9. DAMAGE NECESSITATING REPLACEMENT OF PARTS. Forward engine mount fittings, access door hinges and fasteners must be replaced if damaged. The rear engine mount fork assembly and diagonal truss tube must be replaced if damaged. Obtain engineering approval for welding and reheat treatment of these steel parts.

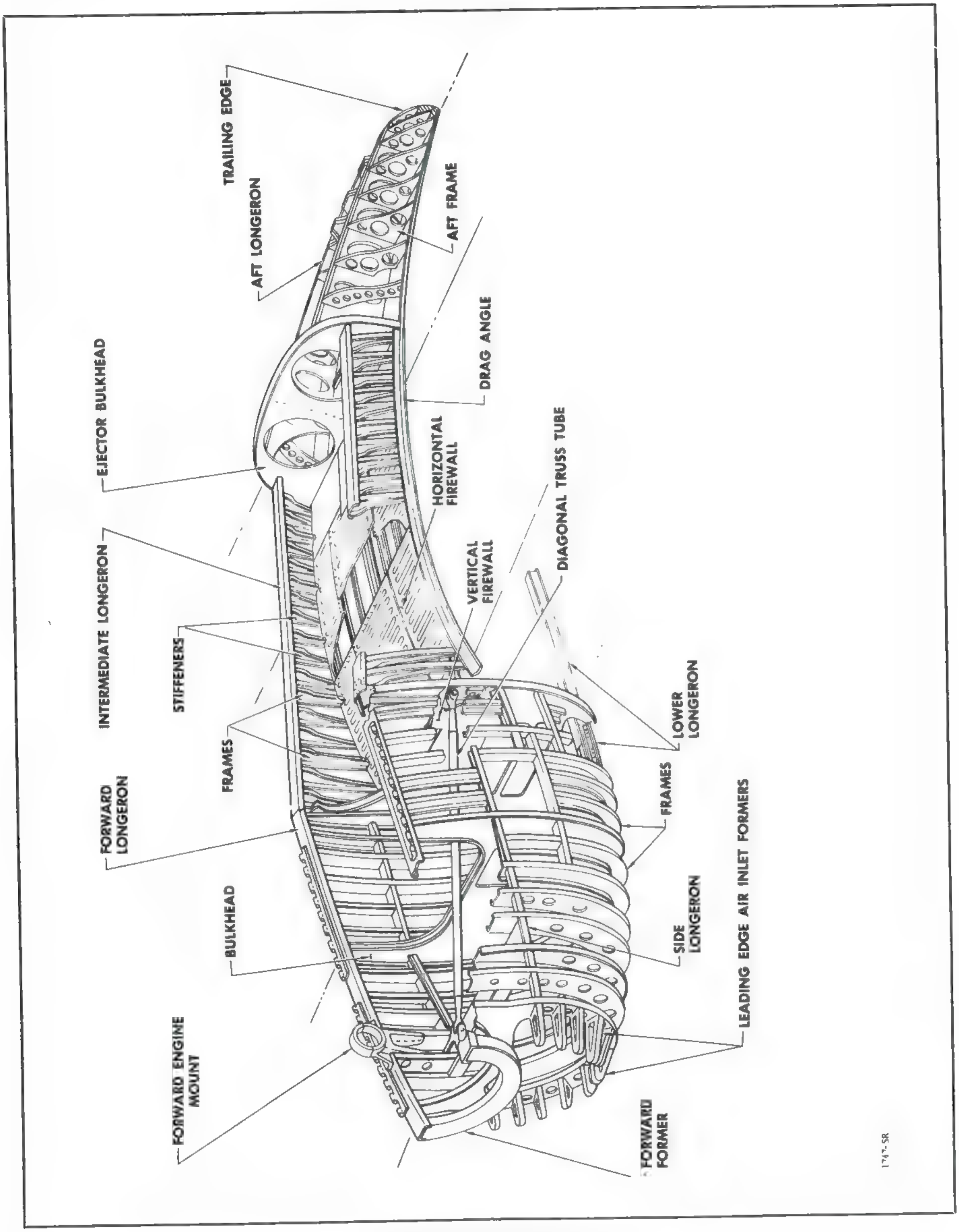


Figure 6-2. Nacelle Structure

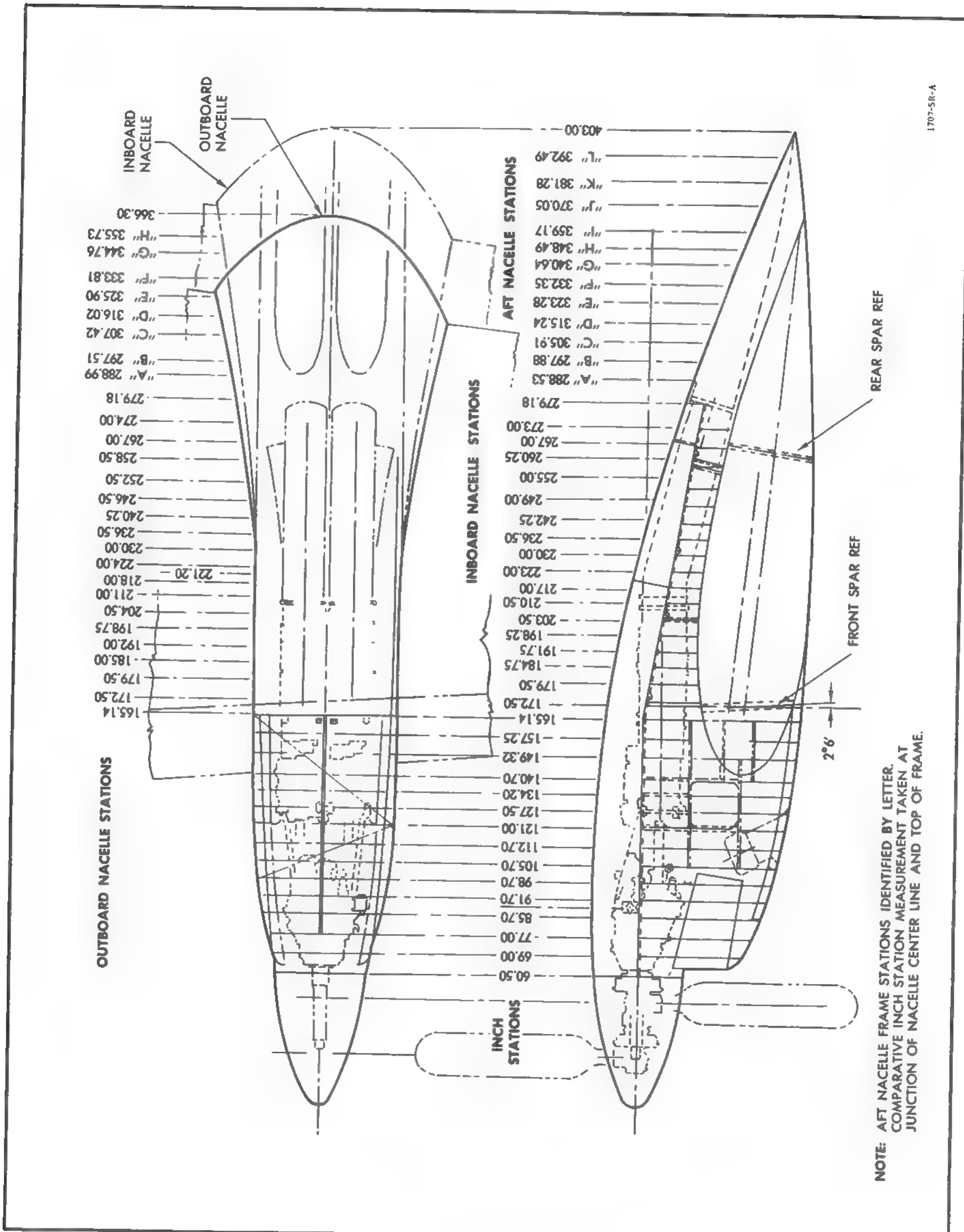


Figure 6-3. Nacelle Stations

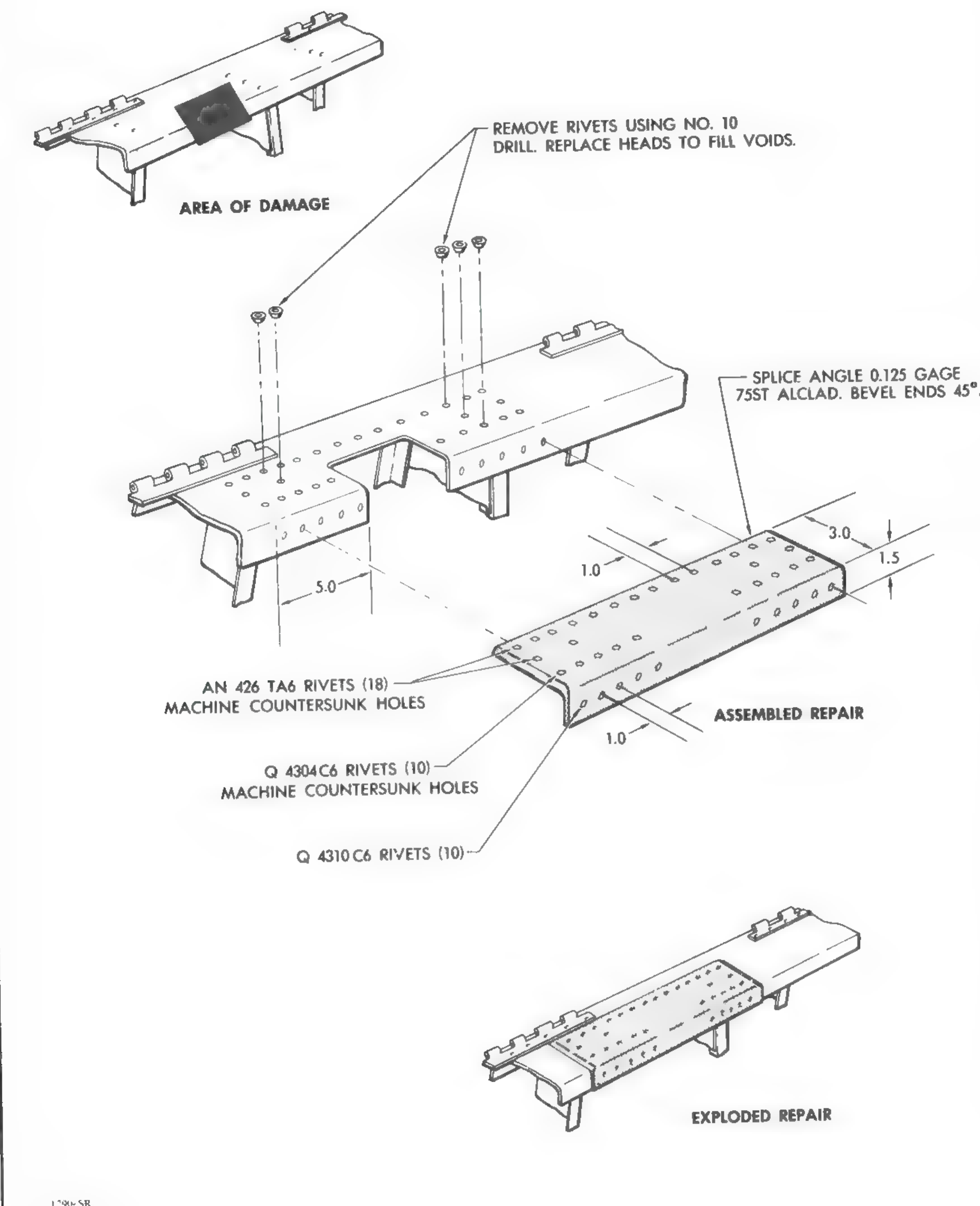


Figure 6-4. Nose Section Upper Longeron Repair

6-10. NACELLE INTERMEDIATE SECTION.

6-11. GENERAL. This section extends from the front to the rear wing spar and above the wing. It houses the power plant turbine section and tail pipes. The nose section is also faired in on the lower surface of the wing, this fairing being larger and longer on the outboard nacelles. Two large access doors are hinged to an upper longeron and are readily removable. The side walls and wing upper surface are lined with a corrosion resistant steel fire curtain.

6-12. CONSTRUCTION. The side walls of the upper portion consist of frames, stiffeners, and upper longerons. The longerons attach to the nose section longerons and extend to the ejector bulkhead at the rear spar. Forces are transmitted from the nose section to the wing interspar section through the frames and skin attached to the wing upper surface. A lower longeron is centered in the nacelle lower section. It transmits forces from the nose section lower longeron to the wing lower surface. In the inboard nacelle, it terminates aft of the wing front spar. In the outboard nacelle it extends to the rear spar. These longerons are of heavy construction and are highly stressed. The access doors consist of formed channel edges and stamped contoured frames. The outer skin is dimpled and flush riveted. The inner skin has beaded lightning holes and is attached with universal head rivets. Frames, stiffeners, and longerons are 75ST alclad. Skin and access doors throughout are 24ST alclad.

6-13. NEGLIGIBLE DAMAGE. (Refer to paragraph 1-38.) Minor dents, nicks and scratches may be classed as negligible. Fatigue cracks in longerons, side and lower skin must be repaired at once. Fatigue cracks may be stop drilled and small holes permitted pending repair in the access doors except at hinge and fastener attachment points.

6-14. DAMAGE REPAIRABLE BY PATCHING. Same as paragraph 6-7. Repairs at longeron attachment will require engineering approval. Damaged corrosion resistant steel fire curtain may be patched, using corrosion resistant steel patch and rivets. Riveting should be sufficient to produce a fire seal equal to manufactured seams in the area.

6-15. DAMAGE REPAIRABLE BY INSERTION. Same as paragraph 6-9.

6-16. DAMAGE NECESSITATING THE REPLACEMENT OF PARTS. Access door hinges and fasteners should be replaced if damaged beyond negligible limits.

6-17. NACELLE AFT SECTION.

6-18. GENERAL. The aft section of the nacelle which is superimposed on and fabricated integrally with the wing trailing edge section. It serves primarily as an aft fairing for the nacelle and incorporates twin exhaust troughs to direct the exhaust gases. Provisions are incorporated for venting and draining.

6-19. CONSTRUCTION. The structure consists of two light beams and stamped frames to which the external skin is attached. These parts are 24ST alclad. The twin troughs are supported by frames mounted on the wing trailing edge upper surface. Trough, frames, and trailing edge skin under the troughs are corrosion resistant steel.

6-20. NEGLIGIBLE DAMAGE. (Refer to paragraph 1-38.) Dents, nicks, scratches, small holes and fatigue cracks which have been stop drilled may be permitted in the aluminum skin and frames, pending repair. Fatigue cracks or holes in the exhaust troughs must be repaired.

6-21. DAMAGE REPAIRABLE BY PATCHING. Same as paragraph 6-7. External patches with protruding head rivets are permissible in the exhaust troughs. Patch to be the same gage as the trough. Attach with double row of 0.093 inch corrosion resistant steel rivets, 0.5 inch pitch.

6-22. DAMAGE REPAIRABLE BY INSERTION. Same as paragraph 6-8.

6-23. DAMAGE NECESSITATING THE REPLACEMENT OF PARTS. The exhaust troughs are attached by screws and are readily replaceable.

This page intentionally left blank

SECTION VII

FABRIC REPAIR AND ATTACHMENT

7-1. On the R3Y airplanes, fabric is not used structurally and, therefore, fabric repairs are not applicable.

SECTION VIII

EXTRUDED SECTIONS AND ROLL-FORMED SECTIONS

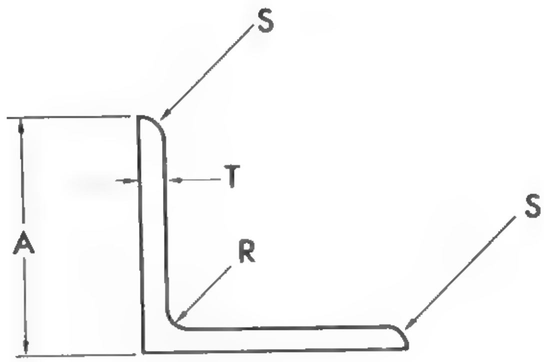
8-1. EXTRUSIONS.

8-2. GENERAL. An extrusion is a die-formed structural shape which can be made to specific cross-sectional dimensions. Extrusions are formed by forcing an aluminum alloy at a plastic temperature through a stationary die by means of a hydraulic ram. The extrusion process makes possible the quantity production of structural shapes which have been designed to facilitate the erection of the structure in which they are used, and in which the metal is disposed more efficiently with relation to the stress it must withstand than is generally possible in standard roll-formed shapes. By the extrusion process it is practical to produce structural shapes with unequal thickness of flanges. Tapered, bulbed, and lipped flanges of any number and with square or controlled-radius edges are readily produced to fill a specific need and often bring about a considerable saving in weight.

8-3. IDENTIFICATION OF EXTRUSIONS. Extruded shapes are identified by a die number which in nearly all cases is preceded by an identifying letter or group of letters. The identifying letters are: AND, K, and HM. Extrusions without an identifying letter are Convair numbers. In compiling the list of extruded shapes, the shapes have been segregated into categories whenever possible and listed in table form. AND's are listed first as their listing arranges them according to size. The AND's are followed by the other extruded shapes according to size starting with the smallest extrusion. The tables contain all the dimensional information and cross section area. Also listed in the tables are the material and when listings of more than one material are given, the material designation of a damaged member generally can be identified by its location. In case of doubt, use 75ST. Extrusion shapes too complex to be grouped in tables are shown by individual illustrations. (See figures 8-1 to 8-13.)

8-4. SUBSTITUTION. In some cases it is satisfactory to substitute a structural member by bend-forming sheet metal of the same material without too many attending disadvantages. In general, however, on these airplanes it shall not be considered permissible to substitute any formed shape for an extruded one. The only substitutes permissible shall be other extruded shapes of equal or slightly larger dimensions and ones fabricated by machining larger extruded shapes to the required dimensions. In the event that the only substitute available is one formed of sheet stock, this substitution would require individual engineering approval.

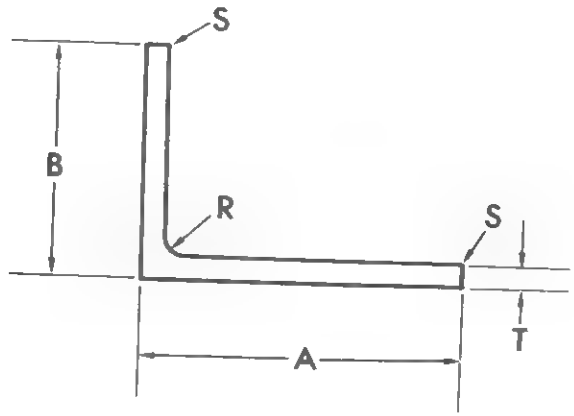
8-5. REPAIRS. Repairs for some of the extruded shapes are illustrated in figure B-2. The principles by which these repairs are designed are discussed in paragraph 1-67. These same principles are applicable in the repair of roll-formed structural members also.



NUMBER	A	T	R	S	AREA	75ST	24ST
AND 10133-							
0601	.750	.063	.094	.063	.0908	—	
1001	1.000	.063	.188	.063	.128	—	
1002	1.000	.094	.188	.094	.183	—	
1003	1.000	.125	.188	.125	.235		—
1401	1.500	.064	.188	.063	.191	—	
1402	1.500	.094	.188	.094	.277	—	
1403	1.500	.125	.188	.125	.360	—	
1404	1.500	.188	.188	.188	.521	—	
2002	2.000	.125	.250	.125	.491	—	
2004	2.000	.250	.250	.250	.924	—	
K22477	.75	.040	.063		.0592		—
K78J	1.00	.062	.062	.031	.121	—	
K30845	1.00	.076	.125	.063	.147	—	
K77B	1.00	.125	.125	.094	.237	—	
K11637	1.50	.094	.094	.047	.273	—	

1750-SR

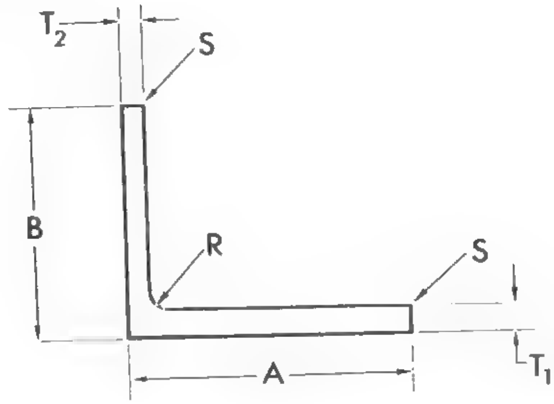
Figure 8-1. Angle 90°—Equal Flange Width and Thickness



NUMBER	A	B	T	R	S	AREA	75ST	24ST
AND 10134-								
1005	1.00	.875	.063	.125	.063	.116	—	
1006	1.00	.875	.094	.125	.094	.167	—	
1204	1.25	1.000	.063	.125	.063	.139		—
1205	1.25	1.000	.094	.125	.094	.202	—	
1206	1.25	1.000	.125	.125	.125	.262	—	
1403	1.50	1.000	.094	.156	.094	.228	—	
1404	1.50	1.000	.125	.156	.125	.295	—	—
1405	1.50	1.000	.156	.156	.156	.361	—	
1406	1.50	1.250	.094	.156	.094	.251	—	
1407	1.50	1.250	.125	.156	.125	.327	—	
1408	1.50	1.250	.156	.156	.156	.400	—	
1603	1.75	1.500	.125	.156	.125	.389	—	
1604	1.75	1.500	.156	.156	.156	.478	—	
2001	2.00	1.000	.125	.156	.125	.358	—	
2002	2.00	1.000	.156	.156	.156	.439	—	
2006	2.00	1.500	.125	.188	.125	.423	—	
2007	2.00	1.500	.156	.188	.156	.519	—	
2010	2.00	1.750	.156	.188	.156	.558	—	
2011	2.00	1.750	.188	.188	.188	.662	—	
2410	2.50	2.250	.188	.250	.188	.856	—	
K1288	1.00	.750	.070	.063	.031	.116		—
K22889	1.25	.813	.062	.125		.128		—
K23154	1.50	1.000	.064	.063		.156	—	
K734LL	1.50	1.250	.188	.188	.125	.482	—	
K11820	1.75	1.000	.080	.094	.063	.214		—
K29426	2.00	1.750	.250	.250	.094	.885	—	
K52798	2.28	2.130	.080	.190	.016	.354		—
K734PP	3.00	2.000	.375	.313	.188	1.745	—	

1751-SR

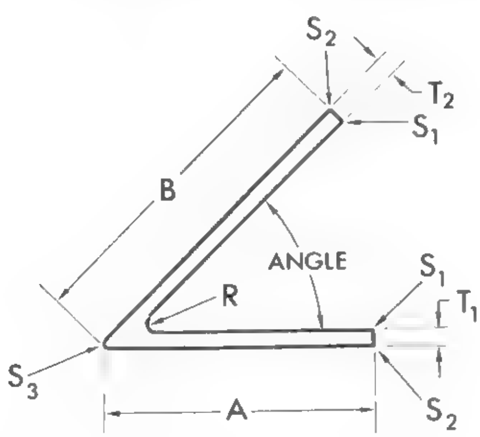
Figure 8-2. Angle 90°—Unequal Flange Width—Equal Thickness



1752-SR

Number	A	B	T_1	T_2	R	S	AREA	75ST	24ST
K59105	1.750	1.500	.188	.125	.156	.016	.498	—	
K41291	2.750	2.188	.281	1.250	.188		3.000	—	
K10273	3.625	1.250	.125	.375	.188		.875	—	—
K30145	3.813	1.750	.188	.500	.188		1.495	—	
HM14787	3.900	3.500	1.250	.560	.250	.031	6.147	—	
HM14394	5.250	5.000	.300	.500	.250	.030	3.937	—	

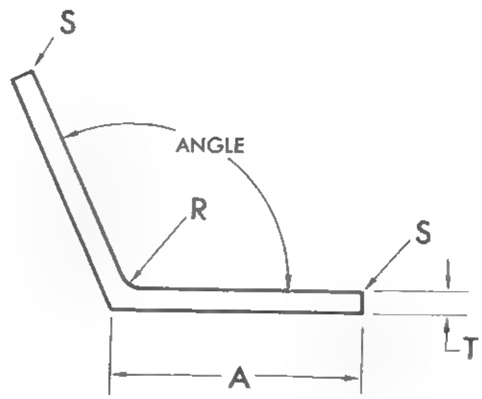
Figure 8-3. Angle 90°—Unequal Flange Width and Thickness



1754-SR

Number	A	B	T_1	T_2	R	S_1	S_2	S_3	ANGLE	AREA	75ST	24ST
K30054	.761	.688	.063	.063	.063	.031			65°	.085		—
K27824	2.000	2.000	.219	.219	.156		.125	.156	69°	.825	—	
HM14789	2.820	2.620	.560	.560	.250	.031	.031	.031	83° 30′	2.711	—	
K28215	3.875	3.438	.625	.438	.250	.063	.063	.063	84° 30′	3.684	—	
HM14788	4.060	3.620	.750	.620	.250				86°	4.81	—	

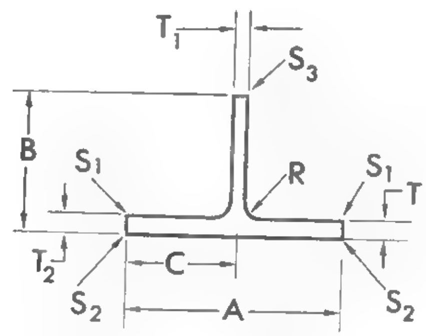
Figure 8-4. Angle—Acute



1753-SR

NUMBER	A	T	R	S	ANGLE	AREA	75ST	24ST
K28969	.75	.064	.125		109°	.092		—
K1557	1.00	.094	.094	.047	112° 30′	.183	—	

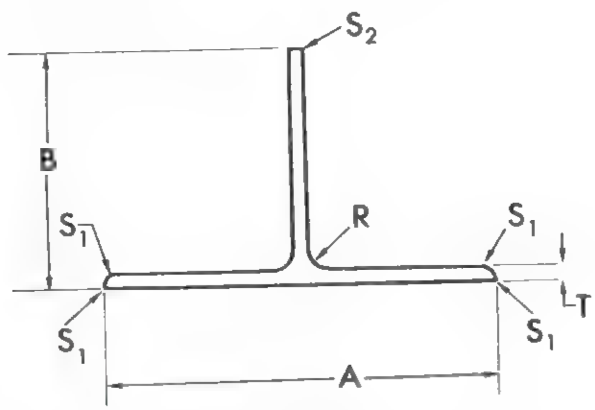
Figure 8-5. Angle—Obtuse



1756-SR

NUMBER	A	B	C	T	T_1	T_2	R	S_1	S_2	S_3	AREA	75ST	24ST
K59050	1.620	4.500		.120	.094		.125	.016			.687	—	
K31445	1.940	4.000	.930	.081	.093		.125	.081			.525	—	
K1566	2.250	2.250		.125	.188		.062	.062	.062	.094	.726	—	—
K40611	2.375	5.156	.875	.165	.120	.125	.125	.032	.032	.032	1.030	—	
K37281	3.000	1.562		.312	.188		.125				1.179	—	
K37586	3.500	2.875		.531	.312		.250	.031	.031	.031	2.620	—	
K32894	3.750	3.000		.078	.125		.125				.664	—	
K59284	4.120	3.120	3.000	.300	.600	.750	.250	.031	.031	.031	4.169	—	
K29655	4.500	3.250		.438	.250		.312	.062			2.678	—	
HM15735	4.860	4.340	2.340	.160	.180		.250	.031	.031	0.31	1.554	—	
K59047	4.860	4.340		.160	.180		.250				1.557		—
K52742	6.000	5.500		.360	.180		.190				3.100		—
K52709	6.000	5.500		.500	.180		.250	.030	.030	.030	3.926		—

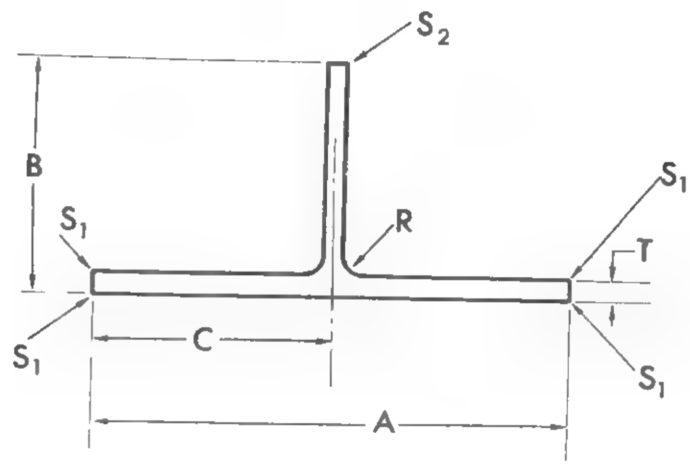
Figure 8-6. "T"—Unequal Flange Thickness



1755-1SR

NUMBER	A	B	C	T	R	S_1	S_2	AREA	75ST	24ST
AND 10136-										
1202	1.250	.625		.050	.094			.127	—	
1302	1.375	1.000		.063	.125			.150	—	
1303	1.375	1.000		.078	.125			.183	—	
1403	1.500	1.000		.078	.125			.193	—	
1503	1.625	1.125		.078	.125			.212	—	
1505	1.625	1.375		.094	.125			.275	—	
1607	1.750	1.625		.094	.125			.310	—	
2001	2.000	1.000		.078	.125			.231	—	
2002	2.000	1.000		.094	.125			.275	—	
2005	2.000	1.250		.094	.125			.299	—	
2006	2.000	1.250		.125	.125			.389	—	
2007	2.000	1.750		.094	.125			.346	—	
2008	2.000	1.750		.125	.125			.451	—	
2408	2.500	2.000		.156	.125			.671	—	
2409	2.500	2.000		.188	.125			.807	—	
3003	3.000	2.000		.156	.125			.749	—	
3-11804-7	1.000	.750		.050	.094			.0888	—	
3-11803-7	1.000	1.000		.050	.094			.1013	—	
K44850	1.125	.750		.040	.125			.0800	—	
3-11802-7	1.350	1.690		.050	.125			.1560	—	
K24822	1.375	.750		.062	.094			.1280	—	
K27477	1.500	1.000		.062	.062	.031	.031	.1520	—	
K29260	1.500	1.125		.040	.040	.040		.1040	—	
K2499	1.500	1.125		.063	.063	.032		.1620	—	—
K59041	1.500	1.250		.050	.094			.1325	—	
K24826	1.500	1.250		.063	.063			.1420	—	
K52966	1.500	3.290		.081	.120	.016	.016	.3870	—	
K23160	1.500	1.500		.064	.125			.1880	—	
K23400	1.500	1.500		.125	.125			.3600	—	
3-11801-7	1.600	1.250		.070	.062			.1960	—	
K59090	1.600	1.250		.070	.125	.016		.2010	—	
K59091	1.600	1.700		.070	.125	.016	.016	.2330	—	

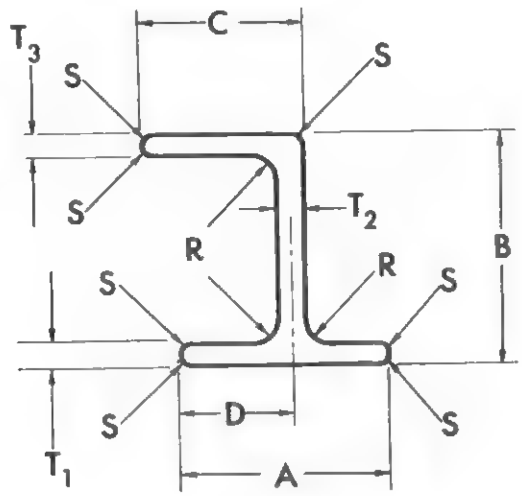
Figure 8-7. "T"—Plain (Sheet 1 of 2)



1755-2SR

NUMBER	A	B	C	T	R	S_1	S_2	AREA	75ST	24ST
HM14345	1.625	1.625		.080	.090	.016	.016	.2570	—	
K59223	1.800	3.250		.080	.090	.016	.016	.4010	—	
K8845	1.875	1.125		.050	.094			.1980	—	
K8684	1.969	1.500		.188	.063	.094	.094	.6220	—	
K32220	2.000	1.130		.050	.090			.1560	—	
K31736	2.000	1.250		.070	.062			.2590	—	
K15047	2.000	1.250		.072	.125			.1280	—	—
K24859	2.000	1.250		.072	.125			.1280	—	—
K28249	2.000	1.250		.094	.125	.094		.2840	—	
K32056	2.000	1.250		.100	.090			.3150	—	
K59395	2.000	1.500		.070	.120	.031	.031	.2450	—	
K30442	2.000	1.500		.094	.156			.3250	—	
K16885	2.000	1.500		.125	.156			.8450	—	
K34690	2.000	1.750		.094	.156	.094		.3495	—	
K59092	2.000	2.000		.080	.125	.016	.016	.3140	—	
K29119	2.000	2.000		.094	.156			.3680	—	
K59093	2.000	2.000		.100	.125	.016	.016	.3960	—	
K14662	2.000	2.125		.125	.125	.063	.063	.5020	—	
K28539	2.000	2.500		.125	.125	.031	.031	.5440	—	
K22675	2.375	2.625		.080	.125			.3940	—	—
K37286	2.375	3.000		.081	.125			.4360	—	
K28241	2.500	2.000		.156	.125	.156		.6780	—	
K37289	2.875	2.750		.125	.125			.6940	—	
K43070	2.970	2.750		.087	.130			.4970	—	
K37587	3.000	1.875		.080	.125	.031	.031	.3900	—	
K29275	3.000	2.000		.125	.180			.4840	—	
K29414	3.000	4.000		.125	.250	.063	.063	1.032	—	
K52986	3.700	2.850	1.942	.125	.130	.031	.031	.972	—	
K32548	4.000	2.530		.100	.190			.6580	—	
K32388	4.000	3.420		.130	.190			.9360	—	
HM14300-3	6.000	5.500		.250	.250	.030	.030	2.8200	—	

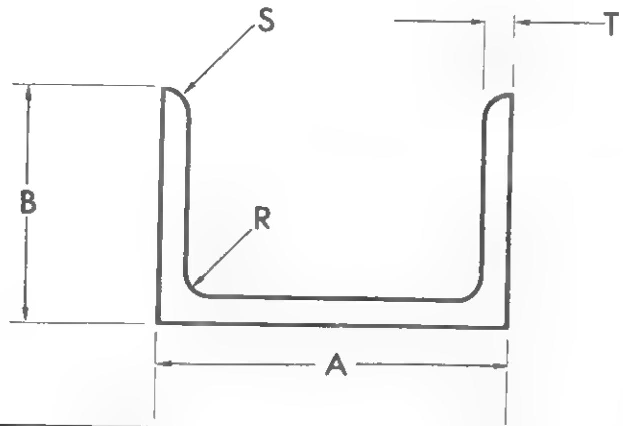
Figure 8-7. "T"—Plain (Sheet 2 of 2)



NUMBER	A	B	C	D	T_1	T_2	T_3	R	S	AREA	75ST
HM14437-3	1.50	1.50	1.00	.750	.070	.070	.070	.120	.016	.278	—
HM14436-3	1.50	1.50	1.00	.750	.080	.080	.080	.120	.016	.315	—
HM14435-3	1.50	1.75	1.00	.750	.080	.080	.080	.120	.016	.335	—
HM14434-3	1.50	2.00	1.00	.750	.090	.090	.090	.120	.016	.397	—
HM14431-3	1.50	2.25	1.00	.750	.110	.110	.110	.120	.016	.506	—
HM14429-3	1.50	2.75	1.00	.750	.140	.140	.140	.120	.031	.740	—
HM14438-3	1.50	2.75	1.00	.750	.180	.180	.180	.120	.031	.888	—
340-8210119	1.88	1.50	1.00	.940	.075	.075	.080	.120		.323	—
K59086	2.00	1.50	1.00	.965	.080	.070	.080	.120	.016	.332	—
K59087	2.25	1.50	1.12	1.125	.110	.110	.110	.120	.016	.507	—
K59089	2.50	1.50	1.25	1.250	.150	.130	.150	.120	.016	.726	—
HM14621	3.14	2.35	1.67	1.57	.310	.200	.200	.180	.031	1.695	—
HM14620	3.14	2.50	1.67	1.57	.500	.200	.200	.180	.031	2.283	—
HM14622	3.14	2.50	1.40	1.632	.330	.125	.125	.180	.031	1.486	—
K52804	3.14	2.56	1.67	1.57	.450	.150	.150	.180	.031	1.977	—
K52803	3.14	2.56	1.67	1.625	.450	.175	.175	.180	.031	2.063	—
HM14323	3.14	2.56	1.67	1.57	.450	.200	.200	.180	.031	2.148	—
HM14387	3.60	2.50	1.40	1.797	.500	.125	.125	.180	.031	2.229	—
HM14388	3.60	2.50	1.67	1.795	.500	.150	.150	.180	.031	2.348	—
HM14389	3.60	2.50	1.67	1.803	.500	.175	.175	.180	.031	2.431	—
HM14390	3.60	2.50	1.67	1.800	.500	.200	.200	.180	.031	2.513	—

1757-SR

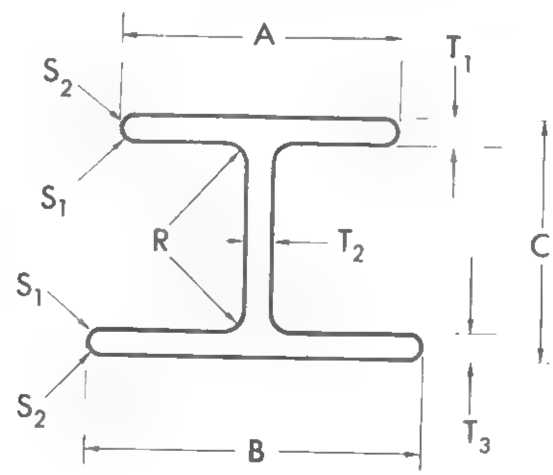
Figure 8-8. "T"—Flanged



NUMBER	A	B	T	R	S	AREA	75ST
AND 10137-							
1105	1.125	.750	.078	.125	.078	.197	—
1106	1.125	.750	.094	.125	.094	.232	—
1110	1.125	.875	.125	.125	.125	.328	—
2002	2.000	1.000	.094	.125	.094	.361	—

1760-SR

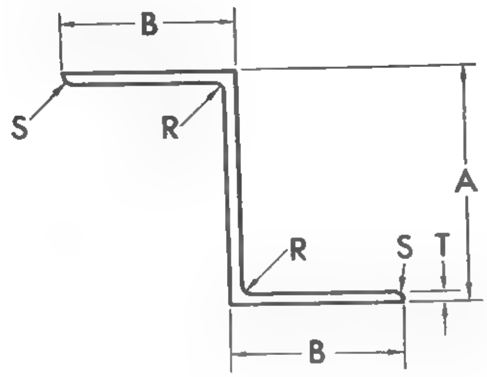
Figure 8-9. Channel—Plain



NUMBER	A	B	C	T_1	T_2	T_3	R	S_1	S_2	AREA	75ST
HM14346	.500	1.500	1.00	.150	.072	.072	.090	.031	.031	.240	—
HM14381	.500	1.750	1.50	.125	.125	.125	.125	.031	.031	.449	—
AND 10140-											
1202	1.625	1.625	1.25	.094	.094	.094	.125	.094		.411	—
2001	2.000	2.000	2.00	.094	.094	.094	.125	.094		.552	—
2002	2.000	2.000	2.00	.125	.125	.125	.125	.125		.719	—

1761-SR

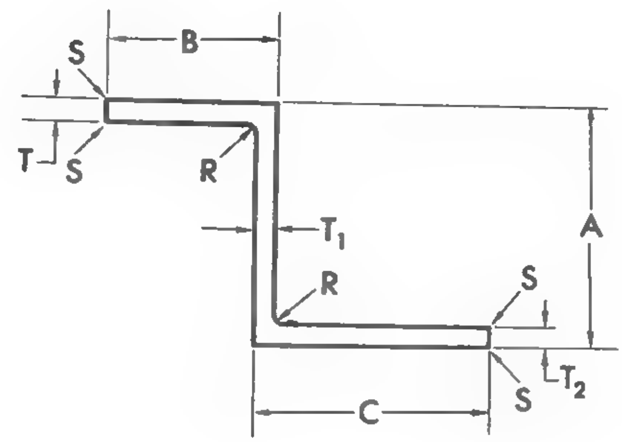
Figure 8-10. "I" Section



NUMBER	A	B	T	R	S	AREA	75ST
AND 10138-							
1303	1.375	1.00	.078	.125	.078	.253	—
1304	1.375	1.00	.094	.125	.094	.298	—
1401	1.500	.75	.078	.125	.078	.223	—
1402	1.500	1.00	.078	.125	.078	.261	—
1403	1.500	1.00	.094	.125	.094	.293	—
2002	2.000	1.00	.094	.125	.094	.358	—
K52993	1.000	.75	.050	.060	.016	.121	—
K52994	1.000	.75	.060	.060	.016	.144	—
K52989	1.000	.75	.070	.060	.016	.166	—
K52990	1.000	.75	.080	.060	.016	.188	—
K52991	1.000	.75	.090	.060	.016	.210	—
HM14299	2.250	1.04	.156	.120	.031	.632	—
HM14326	2.500	1.67	.150	.180	.031	.844	—
HM14325	2.500	1.67	.175	.180	.031	.974	—
HM14324	2.500	1.67	.200	.180	.031	1.101	—

1758-SR

Figure 8-11. "Z"—Plain



NUMBER AND 10139–	A	B	C	T	T_1	T_2	R	S	AREA	75ST
0601	.75	.625	.375	.050	.050	.050	.094	.050	.083	—
1203	1.25	1.000	.625	.063	.063	.063	.125	.063	.177	—
2202	2.25	1.000	.750	.094	.094	.094	.125	.094	.359	—
HM14313	1.25	1.000	1.000	.102	.102	.072	.120	.016	.290	—
HM14314	1.25	1.000	1.000	.114	.114	.072	.120	.016	.313	—
K32733	1.50	.810	.750	.070	.070	.100	.120		.231	—
K32735	1.50	.810	.810	.060	.060	.080	.120		.201	—
K59224	1.50	.810	1.000	.060	.060	.080	.120	.016	.216	—
K43205	1.50	.860	.860	.100	.100	.325	.120		.479	—
K32736	1.50	1.000	1.000	.070	.070	.130	.120		.297	—
K32730	1.50	1.000	1.000	.090	.090	.130	.120		.341	—
HM14315	2.00	1.000	1.000	.102	.102	.072	.120	.016	.366	—
HM14316	2.00	1.000	1.000	.114	.114	.072	.120	.016	.399	—
HM14318	2.00	1.040	1.040	.125	.125	.080	.120	.031	.442	—
HM14317	2.25	1.000	1.000	.114	.114	.085	.120	.031	.439	—
HM14320	2.25	1.100	1.100	.190	.190	.190	.120	.031	.778	—
HM14319	2.25	1.040	1.040	.125	.125	.080	.120	.031	.474	—
HM14321	2.25	1.140	1.140	.220	.190	.220	.120	.031	.850	—
HM14391	2.35	1.670	1.880	.150	.150	.150	.180	.031	.853	—
HM14392	2.35	1.670	1.880	.175	.175	.175	.180	.031	.984	—
HM14386	2.50	1.400	1.670	.125	.125	.125	.180	.031	.678	—
HM14385	2.56	1.400	1.670	.125	.125	1.380	.180	.031	2.624	—
HM14304	2.56	1.670	1.670	.150	.150	1.400	.180	.031	2.753	—

1759-SR

Figure 8-12. "Z"—Unequal Flange Width and Thickness

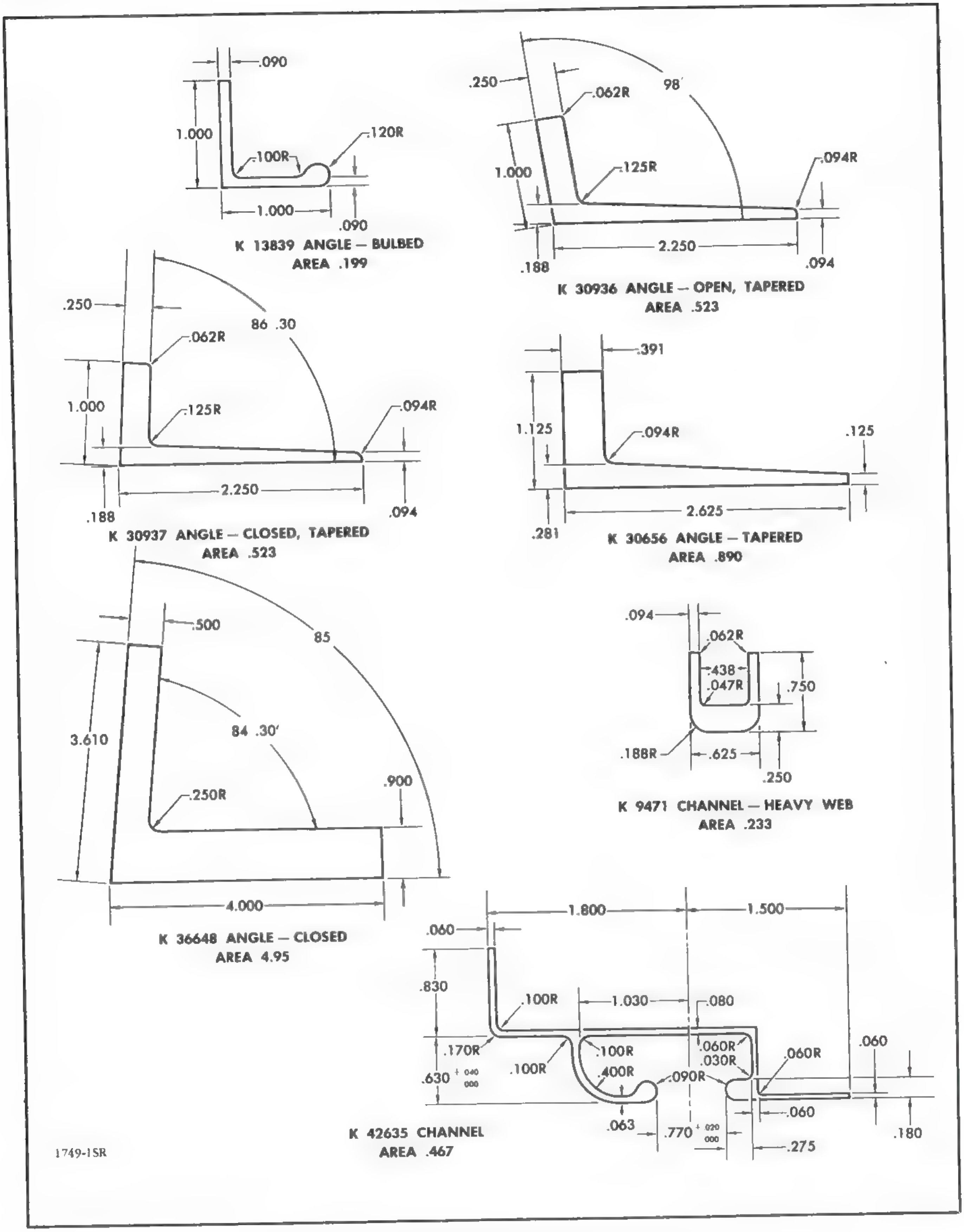


Figure 8-13. Special Extruded Shapes (Sheet 1 of 8)

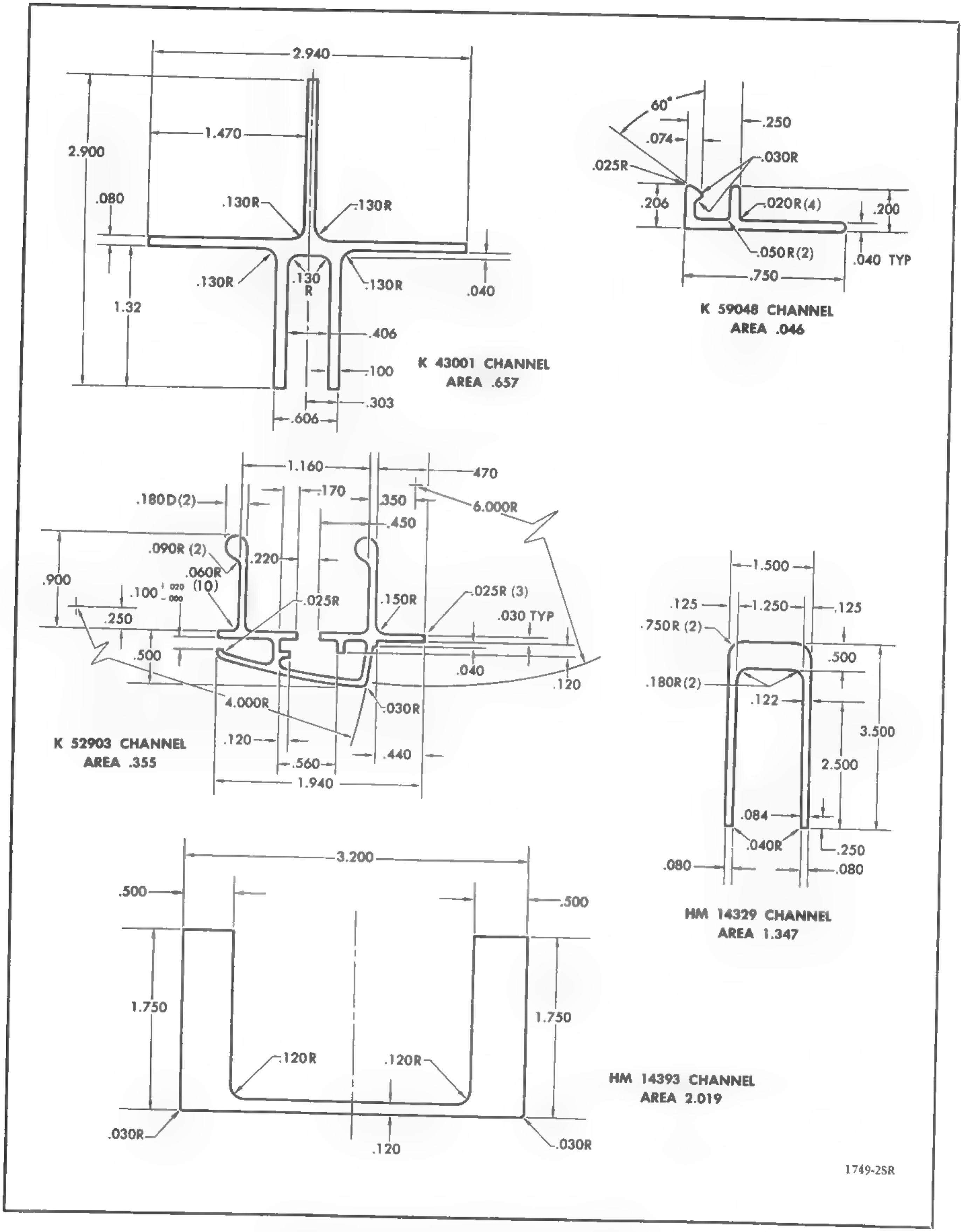


Figure 8-13. Special Extruded Shapes (Sheet 2 of 8)

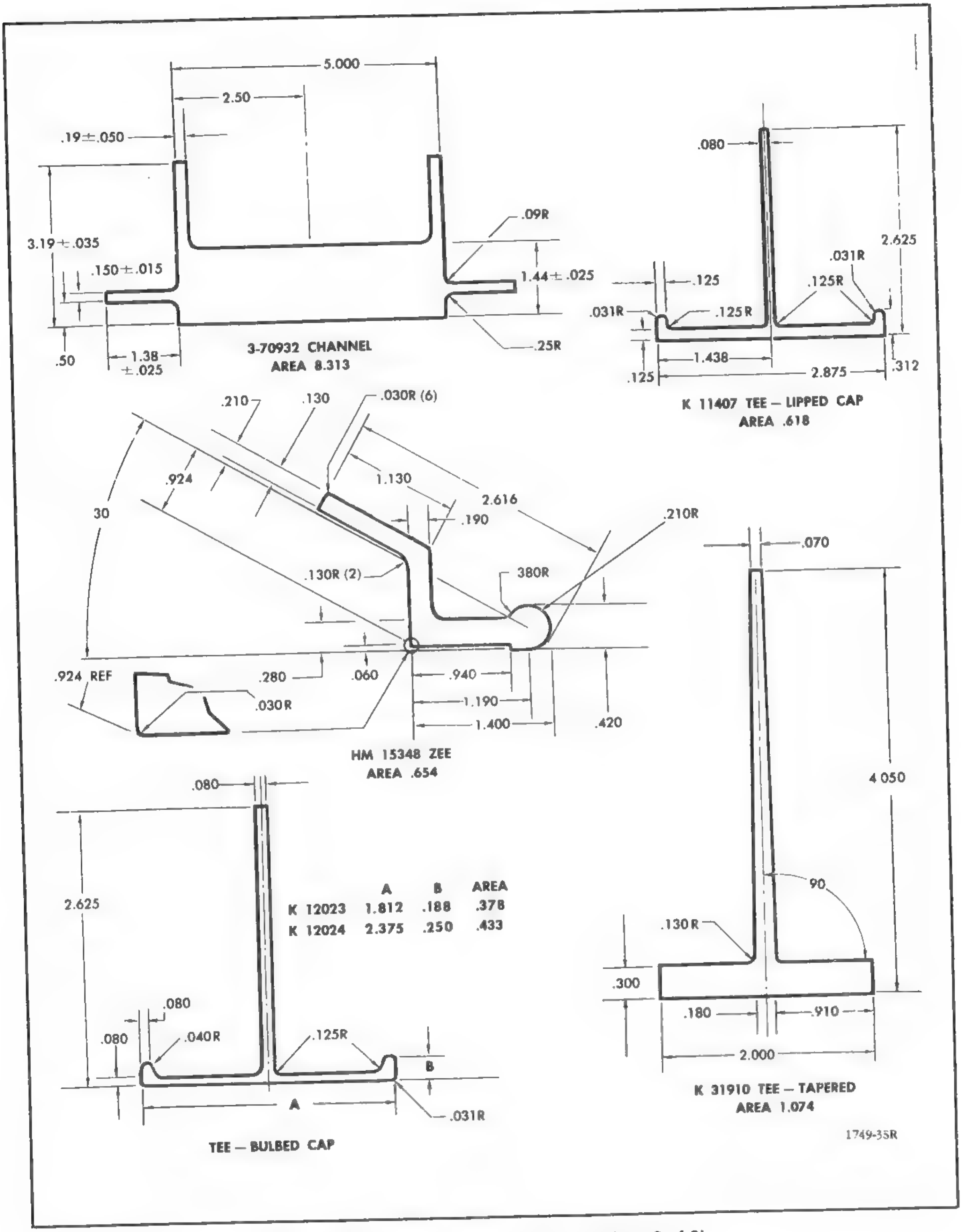


Figure 8-13. Special Extruded Shapes (Sheet 3 of 8)

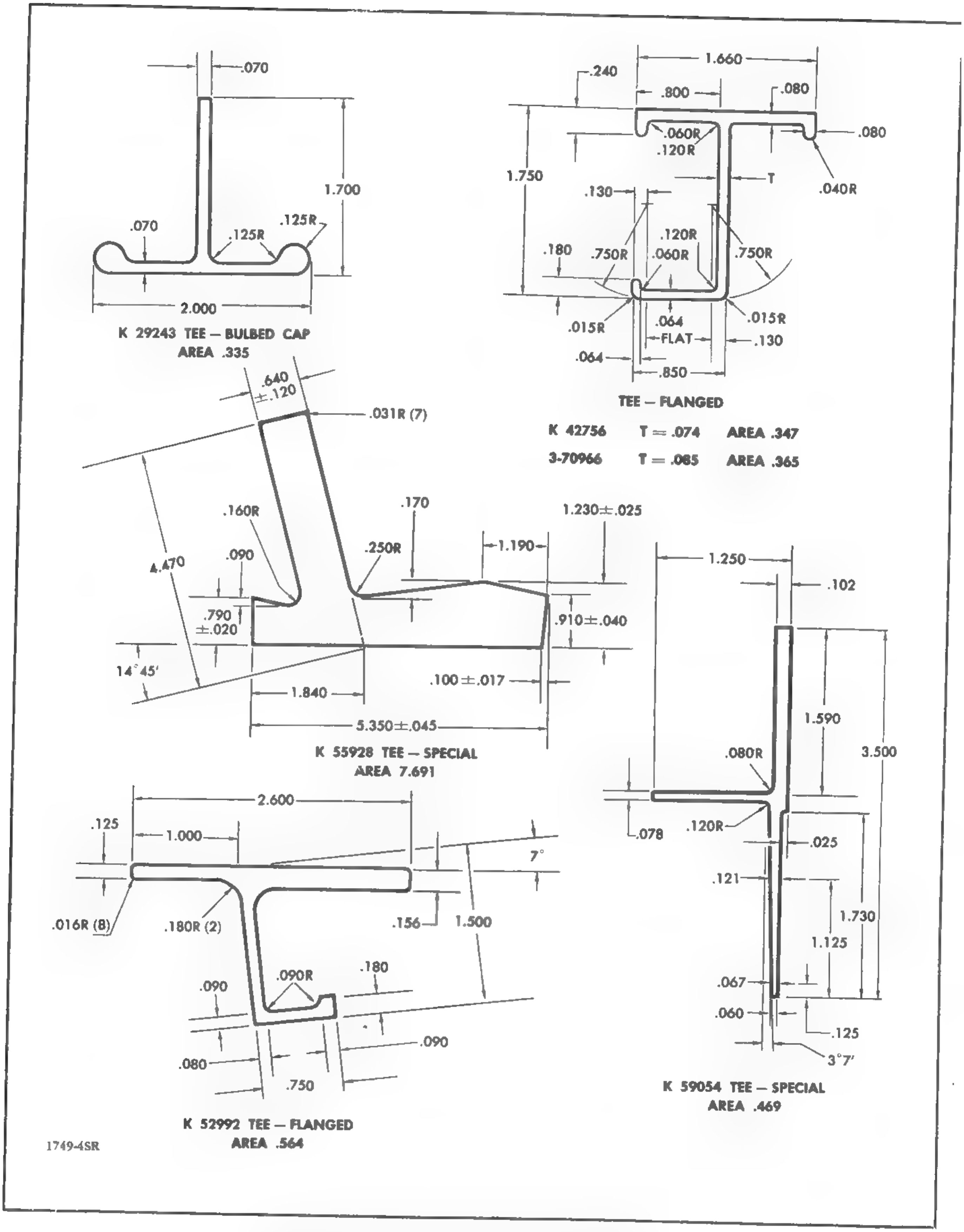
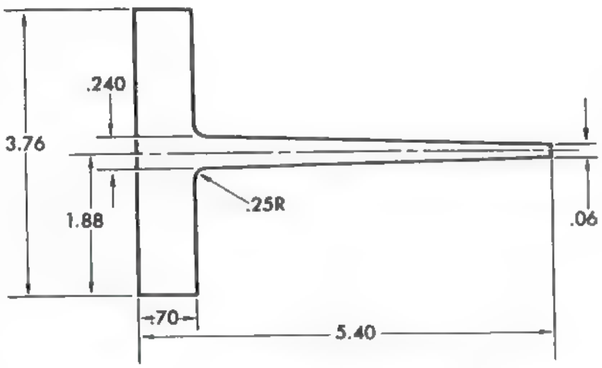
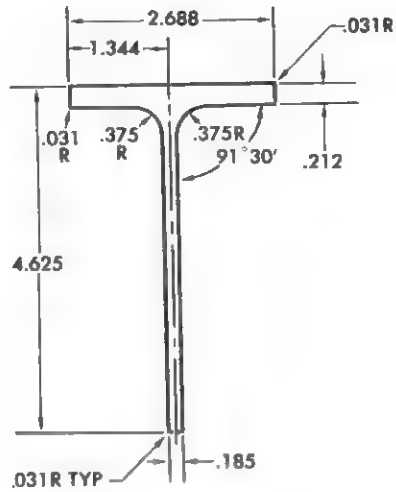


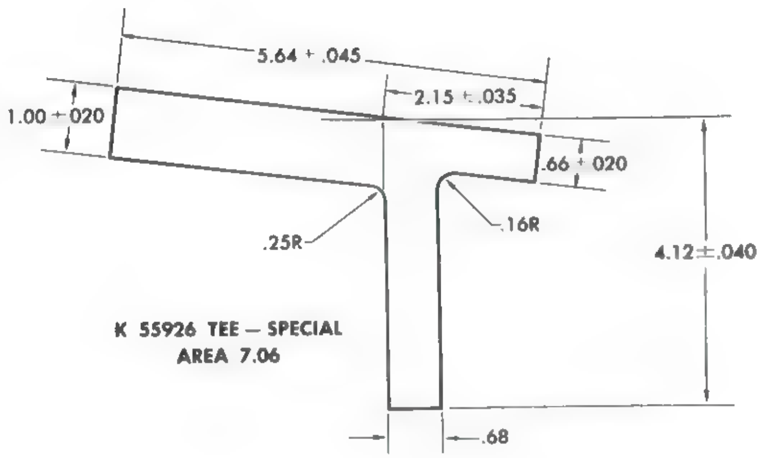
Figure 8-13. Special Extruded Shapes (Sheet 4 of 8)



3-19802 TEE — SPECIAL
AREA 4.048

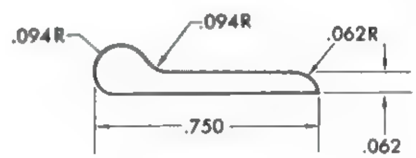


A 15383 TEE — SPECIAL
AREA 1.280

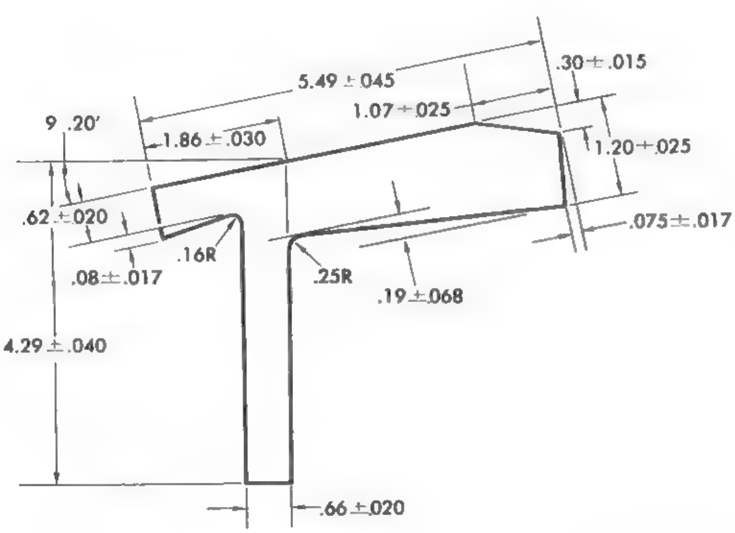


K 55926 TEE — SPECIAL
AREA 7.06

K 12890 BAR — OFFSET
AREA .065



K 55927 TEE — SPECIAL
AREA 7.20



1749-5SR

Figure 8-13. Special Extruded Shapes (Sheet 5 of 8)

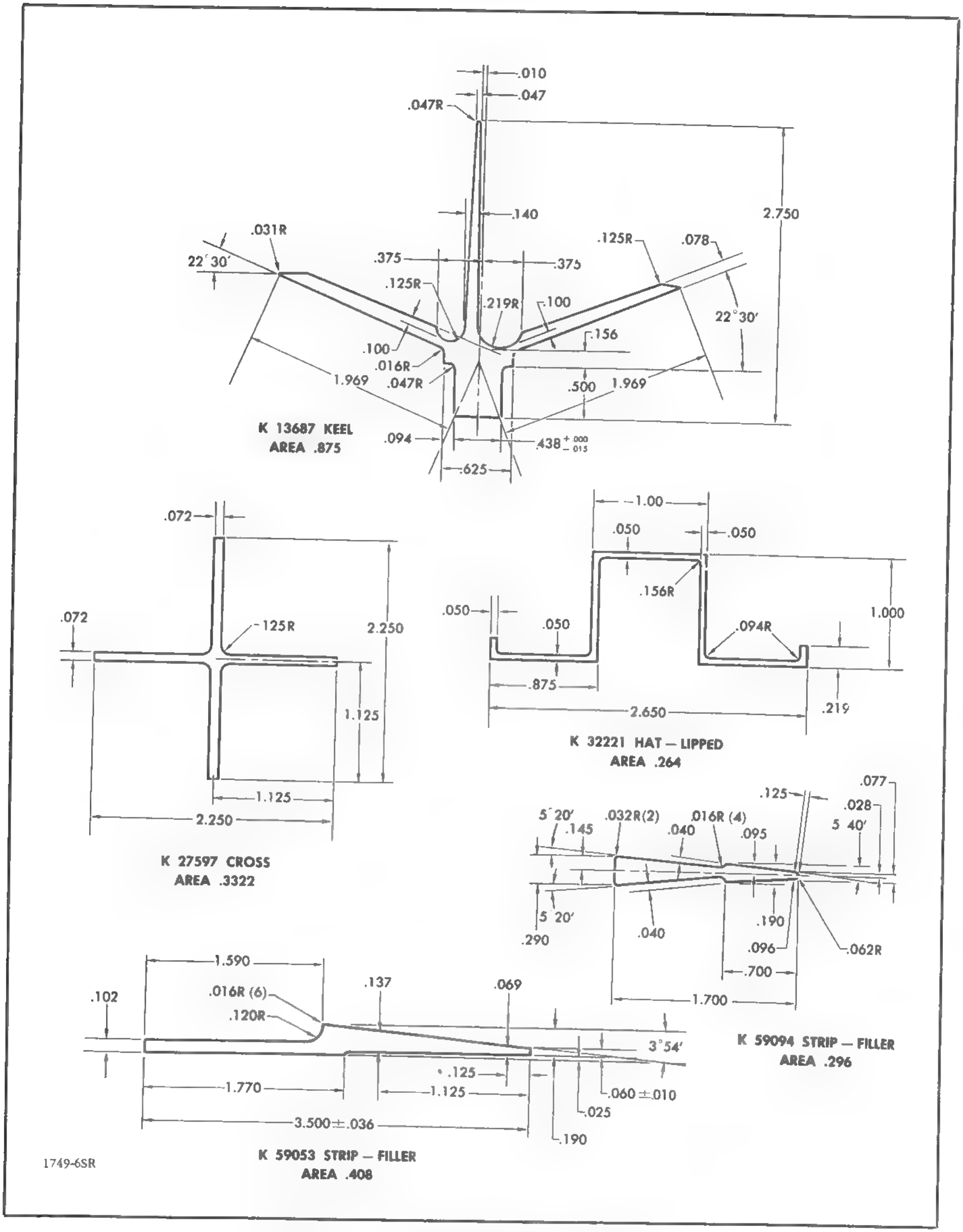


Figure 8-13. Special Extruded Shapes (Sheet 6 of 8)

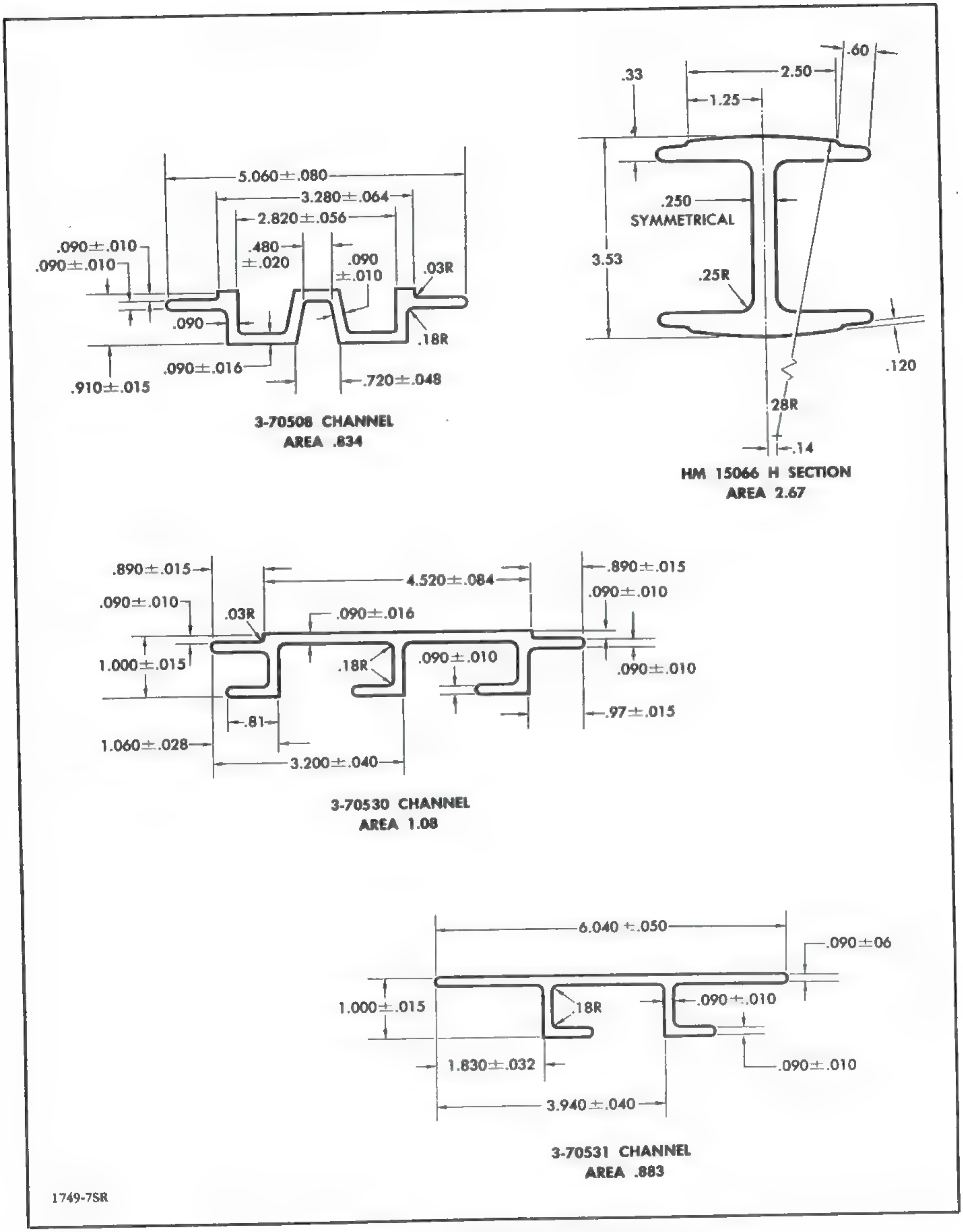


Figure 8-13. Special Extruded Shapes (Sheet 7 of 8)

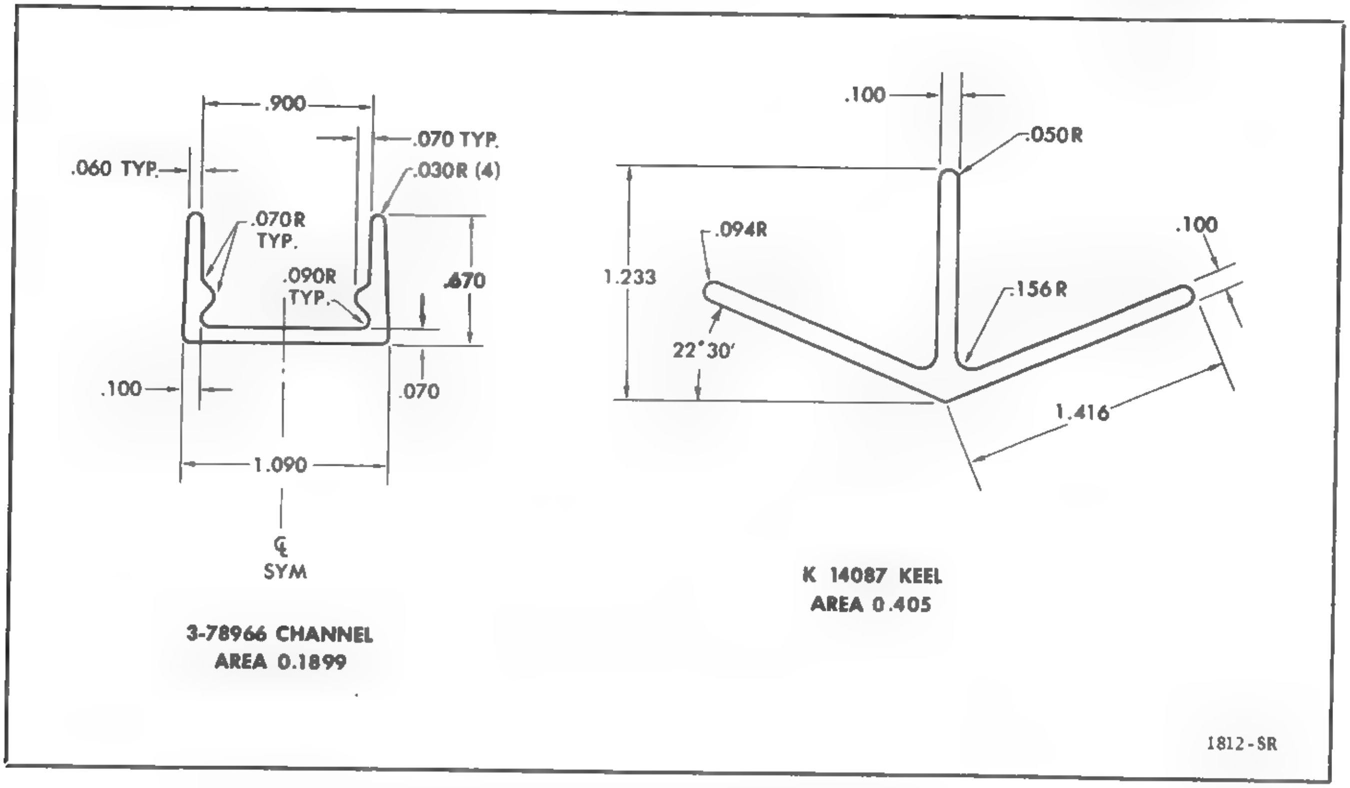


Figure 8-13. Special Extruded Shapes (Sheet 8 of 8)

8-6. ROLL-FORMED SECTIONS.

8-7. GENERAL. Roll-formed shapes used as structural members are very commonly used throughout these airplanes. In many cases they can serve the same purpose as extruded shapes. Roll-formed sections have the advantage of lower cost as compared to extrusions but cannot be made in as large a variety of shapes as extrusions. Roll-formed shapes can only have two flanges and one uniform thickness.

8-8. IDENTIFICATION OF ROLL-FORMED SECTIONS. The identification numbers are Convair, a Division of General Dynamics Corporation's designations. Each number is preceded by the letter Y. A typical example of how a roll-formed structural shape is identifiable would be Y2B-39T. Y2 only identifies it as a Convair angle of 90 degrees; B indicates that it is manufactured from 75S Alclad; (If A had been used it would indicate 24S Alclad); the -39 indicates the dimensions as shown in the table; the T after the -39 indicates that the material is in the hardened condition. As listed in the tables the material identification letters A or B have been omitted; instead the material is indicated in a separate column. The condition identification letter T of the repair material has also been omitted in the tables as all members when installed in the airplane are in the T condition. The various shapes are grouped in separate tables. Each table is arranged starting with the smallest shape. (See figures 8-14 to 8-27.)

8-9. SUBSTITUTION. Roll-formed sections are made of 24ST Alclad and 75ST Alclad. With proper equipment, substitutes for all Y sections can be fabricated. 24S can usually be formed to the required dimensions even in the hard condition; 75S, being harder than 24S, must generally be in the SO or SW condition when being formed.

8-10. REPAIRS. Repairs and principles of repairs dealing with extruded structural shapes also apply for roll-formed shapes. (Refer to paragraph 1-67 and see figure B-3.)

8-11. USES. Extruded and roll-formed structural shapes are used throughout this airplane as stringers, stiffeners, spar rails, and when cut into short lengths they are used as clips and fittings. A number of highly specialized stringers and spar rails are modified extrusions, the modification consisting of machining extruded sections to obtain lengthwise taper.

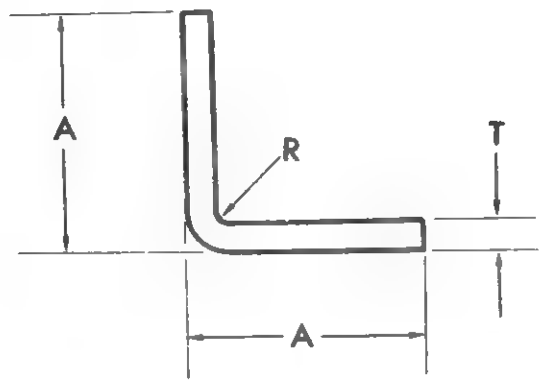
EXTRUSION AND ROLL FORMED INDEX

Extrusion Die Number	Figure	Extrusion Die Number	Figure	Extrusion Die Number	Figure	Extrusion Die Number	Figure
A 15383	8-13	HM 14435-3	8- 8	K 23160	8- 7	K 36648	8-13
AND 10133	- 1	14436-3	- 8	23400	- 7	37281	- 6
10134	- 2	14437-3	- 8	24822	- 7	37286	- 7
10136	- 7	14438-3	- 8	24826	- 7	37289	- 7
10137	- 9	14620	- 8	24859	- 7	37586	- 6
10138	-11	14621	- 8	27477	- 7	37587	- 7
10139	-12	14622	- 8	27597	-13	40611	- 6
AND 10140	-10	14787	- 3	27824	- 4	41291	- 3
HM 14299	-11	14788	- 4	28215	- 4	42635	-13
14300-3	- 7	14789	- 4	28241	- 7	42756	-13
14304	-12	15066	-13	28249	- 7	43001	-13
14313	-12	15348	-13	28539	- 7	43070	- 7
14314	-12	HM 15735	- 6	28969	- 5	43205	-12
14315	-12	K 77B	- 1	29119	- 7	44850	- 7
14316	-12	78J	- 1	29243	-13	52709	- 6
14317	-12	734LL	- 2	29260	- 7	52742	- 6
14318	-12	734PP	- 2	29275	- 7	52798	- 2
14319	-12	1288	- 2	29414	- 7	52803	- 8
14320	-12	1556	- 6	29426	- 2	52804	- 8
14321	-12	1557	- 5	29655	- 6	52903	-13
14323	- 8	2499	- 7	30054	- 4	52966	- 7
14324	-11	8684	- 7	30145	- 3	52986	- 7
14325	-11	8845	- 7	30442	- 7	52989	-11
14326	-11	9471	-13	30656	-13	52990	-11
14329	-13	10237	- 3	30845	- 1	52991	-11
14345	- 7	11407	-13	30936	-13	52992	-13
14346	-10	11637	- 1	30937	-13	52993	-11
14381	-10	11820	- 2	31445	- 6	52994	-11
14385	-12	12023	-12	31736	- 7	55926	-13
14386	-12	12024	-13	31910	-13	55927	-13
14387	- 8	12890	-13	32056	- 7	55928	-13
14388	- 8	13687	-13	32220	- 7	59041	- 7
14389	- 8	13839	-13	32221	-13	59047	- 6
14390	- 8	14087	-13	32388	- 7	59048	-13
14391	-12	14662	- 7	32548	- 7	59050	- 6
14392	-12	15047	- 7	32730	-12	59053	-13
14393	-13	16885	- 7	32733	-12	59054	-13
14394	- 3	22477	- 1	32735	-12	59086	- 8
14429-3	- 8	22675	- 7	32736	-12	59087	- 8
14431-3	- 8	22889	- 2	32894	- 6	59089	- 8
14434-3	- 8	23154	- 2	34690	- 7	59090	- 7

EXTRUSION AND ROLL FORMED INDEX (Cont)

Extrusion Die Number	Figure
K 59091	8- 7
59092	- 7
59094	-13
59095	- 7
59105	- 3
59223	- 7
59224	-12
59284	- 6
K 59395	- 7
3-11801-7	- 7
3-11802	- 7
3-11803	- 7
3-11804	- 7
3-19802	-13
3-70508	-13
3-70530	-13
3-70531	-13
3-70932	-13
3-70966	-13
3-78966	-13
340-8210119	- 8

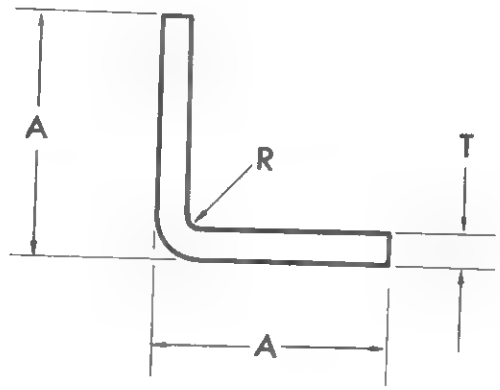
Roll Formed Member	Figure	Roll Formed Member	Figure
Y 2-	8-14	3-10805-19	8-14
Y 3-	-15	-21	-14
Y 4-	-16	3-10805-11	-18
Y 5-	-17	-13	-18
Y 6-	-18	-17	-18
Y 7-	-19	-23	-18
Y10-	-20	3-10806-	-21
Y11-	-21	3-10807-	-20
Y12-	-21	3-13964-7	-24
Y13-	-22	3-14933-7	-20
Y14-	-22	3-16841-7	-26
Y20-	-23	3-16870-7	-24
Y31-	-23		
Y32-	-23	Corrosion Resistant Steel	
Y33-	-24		
Y34-	-24	3-10805-	-27
Y36-	-25	3-10806-	-27
Y50-	-26	3-10807-	-27
3-10805-7	-14		
-9	-14		



Number	A	R	T	Area	75ST	24ST
Y2-2	.625	.094	.051	.0585	—	—
Y2-3	.812	.094	.064	.0964	—	—
Y2-4	.500	.062	.032	.0299	—	—
Y2-5	.500	.062	.040	.037	—	—
Y2-9	1.000	.125	.091	.1671	—	—
Y2-10	.75	.125	.091	.1216	—	
Y2-11	.562	.062	.040	.0420	—	—
Y2-12	.562	.062	.051	.0528	—	—
Y2-13	1.250	.094	.091	.2138	—	
Y2-14	.625	.188	.020	.0229		—
Y2-15	.875	.094	.040	.0664	—	—
Y2-16	.625	.062	.064	.0669	—	
Y2-17	.625	.188	.040	.0448	—	—
Y2-21	.750	.156	.125	.1601	—	—
Y2-23	.750	.188	.032	.0442	—	—
Y2-24	.750	.188	.040	.0548	—	—
Y2-25	.750	.188	.051	.0692	—	—
Y2-26	.750	.188	.064	.0859	—	—
Y2-27	.750	.094	.064	.0885	—	—
Y2-28	.755	.094	.072	.0988	—	
Y2-34	.875	.188	.051	.0820	—	—
Y2-35	.875	.188	.064	.1019	—	—
Y2-39	1.125	.156	.125	.2539	—	—

1762-1 SR

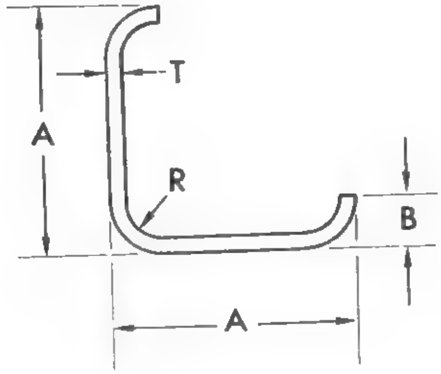
Figure 8-14. Angle 90°—Plain (Sheet 1 of 2)



Number	A	R	T	Area	75ST	24ST
Y2-40	1.000	.125	.125	.2243	—	
Y2-43	1.000	.188	.040	.0748	—	—
Y2-44	1.000	.188	.051	.0947	—	—
Y2-45	1.000	.188	.064	.1179	—	—
Y2-46	1.000	.094	.072	.1348	—	—
Y2-47	1.000	.188	.081	.1475	—	—
Y2-48	1.000	.188	.091	.1646	—	—
Y2-49	1.000	.125	.102	.1859	—	—
Y2-50	1.000	.250	.125	.2176	—	—
Y2-54	1.250	.188	.051	.1202	—	—
Y2-55	1.250	.188	.064	.1499	—	—
Y2-57	1.250	.188	.081	.1880	—	
Y2-58	1.250	.188	.091	.2101	—	
Y2-60	1.250	.250	.125	.2801	—	
Y2-65	1.500	.188	.064	.1617	—	—
Y2-69	1.500	.094	.102	.2893	—	
Y2-70	1.250	.156	.156	.3109	—	
Y2-80	1.375	.188	.081	.2082	—	
Y2-89	1.500	.156	.125	.3476	—	
Y2-90	1.000	.094	.064	.1204	—	—
3-10805-7	.500	.060	.016	.0153	—	—
3-10805-9	.500	.060	.020	.0190	—	
3-10805-19	.625	.060	.030	.0356	—	
3-10805-21	.625	.090	.062	.0704	—	

1762-2 SR

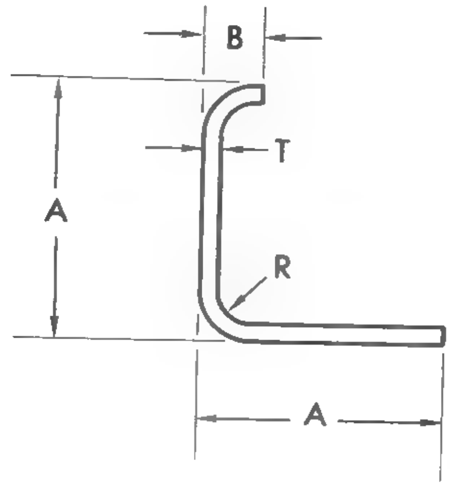
Figure 8-14. Angle 90°—Plain (Sheet 2 of 2)



Number	A	B	R	T	Area	75ST	24ST
Y3-15	.625	.156	.125	.025	.0326		—
Y3-16	.625	.156	.125	.032	.0409	—	—
Y3-22	.750	.188	.125	.040	.0628	—	—
Y3-23	.750	.156	.125	.032	.0490	—	—
Y3-25	.750	.188	.125	.051	.0781	—	—
Y3-26	.750	.188	.125	.064	.0960	—	—
Y3-34	.875	.188	.125	.051	.0907	—	—
Y3-35	.875	.188	.125	.064	.1111	—	—
Y3-42	1.000	.156	.125	.032	.0653	—	—
Y3-43	1.000	.188	.125	.040	.0825	—	
Y3-44	1.000	.188	.125	.051	.1046	—	
Y3-45	1.000	.188	.125	.064	.1280	—	—
Y3-55	1.250	.188	.125	.064	.1600	—	
Y3-57	1.250	.219	.125	.080	.1968	—	
Y3-67	1.500	.219	.125	.091	.2680	—	
Y3-81	2.000	.188	.125	.064	.2560	—	
Y3-84	2.000	.219	.125	.091	.3583	—	

1763-SR

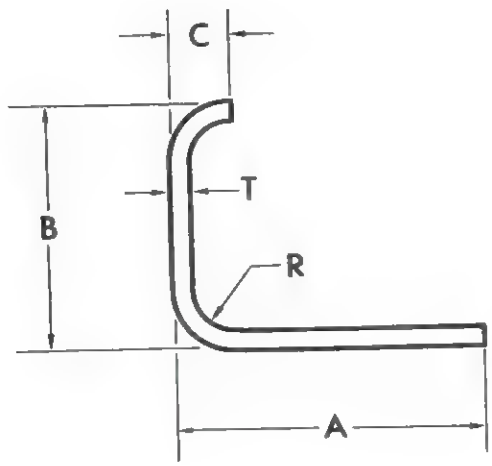
Figure 8-15. Angle 90°—Equal Leg—Flanged



Number	A	B	R	T	Area	75ST	24ST
Y4-17	.625	.188	.125	.040	.0500	—	
Y4-23	.750	.156	.125	.032	.0480	—	—
Y4-24	.750	.188	.125	.040	.0600	—	—
Y4-25	.750	.188	.125	.051	.0748	—	—
Y4-26	.750	.188	.125	.064	.0920	—	—
Y4-33	.875	.188	.125	.040	.0693	—	—
Y4-35	.875	.188	.125	.064	.1073	—	—
Y4-43	1.000	.188	.125	.040	.0793	—	—
Y4-44	1.000	.188	.125	.051	.1004	—	—
Y4-45	1.000	.188	.125	.064	.1239	—	—
Y4-46	1.000	.219	.125	.072	.1394	—	
Y4-47	1.000	.219	.125	.081	.1540	—	
Y4-49	1.000	.312	.188	.102	.1944	—	
Y4-55	1.250	.188	.125	.064	.1559	—	
Y4-57	1.250	.219	.125	.081	.1935	—	
Y4-58	1.250	.219	.125	.091	.2161	—	
Y4-65	1.500	.188	.125	.064	.1919	—	
Y4-67	1.500	.219	.125	.081	.2349	—	
Y4-68	1.500	.219	.125	.091	.2644	—	
Y4-70	1.500	.312	.188	.125	.3580	—	
Y4-85	2.000	.188	.125	.064	.2515	—	
Y4-87	2.000	.219	.125	.081	.3135	—	
Y4-90	2.000	.312	.188	.125	.4750	—	

1764-SR

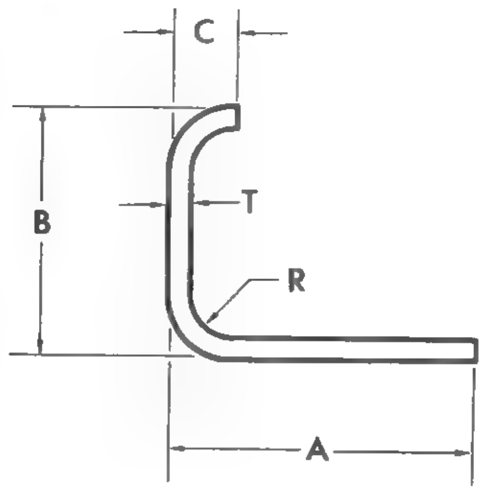
Figure 8-16. Angle 90°—Equal Leg—One Leg Flanged



Number	A	B	C	R	T	Area	75ST	24ST
Y5-3	.750	.625	.188	.125	.032	.044	—	
Y5-9	.750	.625	.188	.125	.040	.0550	—	—
Y5-16	.875	.750	.188	.125	.051	.0812	—	—
Y5-17	.875	.750	.188	.125	.064	.0998	—	—
Y5-19	.875	1.125	.312	.188	.125	.2310	—	—
Y5-21	1.000	.750	.188	.125	.040	.0700	—	
Y5-22	1.000	.750	.188	.125	.051	.0870	—	—
Y5-23	1.000	.750	.188	.125	.064	.1079	—	—
Y5-24	1.000	.750	.219	.125	.072	.1214	—	
Y5-26	1.000	.750	.219	.125	.091	.1490	—	
Y5-28	1.000	.875	.188	.125	.064	.1159	—	—
Y5-29	1.125	.875	.188	.125	.040	.0787	—	—
Y5-31	1.250	.750	.188	.125	.040	.0800	—	—
Y5-32	1.250	.750	.188	.125	.051	.1004	—	—
Y5-33	1.250	.750	.188	.125	.064	.1239	—	
Y5-38	1.250	.875	.188	.125	.064	.1319	—	
Y5-42	1.250	1.000	.188	.125	.051	.1131	—	—
Y5-43	1.250	1.000	.188	.125	.064	.1400	—	—
Y5-44	1.250	1.000	.219	.125	.072	.1575	—	
Y5-45	1.250	1.000	.219	.125	.081	.1749	—	

1765-1SR

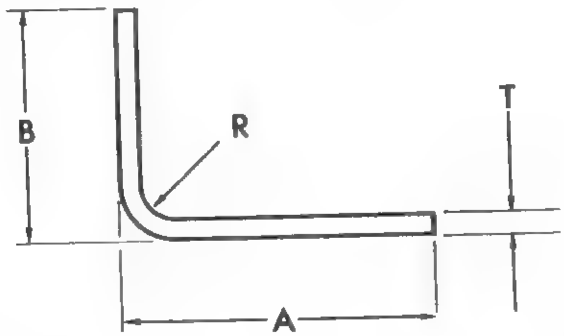
Figure 8-17. Angle 90°—Unequal Leg—One Leg Flanged (Sheet 1 of 2)



Number	A	B	C	R	T	Area	75ST	24ST
Y5-46	1.250	1.000	.219	.125	.091	.1961	—	
Y5-65	1.500	.750	.219	.125	.091	.1950	—	
Y5-68	1.500	.875	.188	.125	.064	.1479	—	
Y5-72	1.500	1.000	.188	.125	.064	.1556	—	—
Y5-73	1.500	1.000	.219	.125	.072	.1755	—	
Y5-74	1.500	1.000	.219	.125	.081	.1936	—	
Y5-75	1.500	1.000	.219	.125	.091	.2189	—	
Y5-82	1.500	1.250	.188	.125	.064	.1719	—	—
Y5-85	1.500	1.250	.375	.188	.125	.3320	—	
Y5-94	1.750	.750	.219	.125	.081	.1949	—	
Y5-101	1.750	1.000	.219	.125	.051	.1366	—	
Y5-102	1.750	1.000	.219	.125	.064	.1714	—	—
Y5-116	1.750	1.250	.312	.188	.102	.2964	—	—
Y5-124	1.750	1.500	.219	.125	.081	.2549	—	
Y5-127	1.750	1.500	.375	.250	.125	.3884	—	
Y5-183	2.250	.750	.188	.125	.064	.1868	—	
Y5-206	2.250	1.250	.219	.125	.091	.3099	—	
Y5-240	2.375	1.000	.250	.125	.081	.2674	—	
Y5-260	2.750	1.500	.250	.125	.081	.3374	—	—

1765-2SR

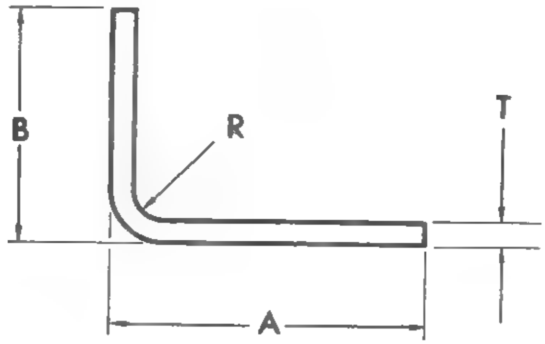
Figure 8-17. Angle 90°—Unequal Leg—One Leg Flanged (Sheet 2 of 2)



1766-1 SR

Number	A	B	R	T	Area	75ST	24ST
Y6-2	.625	.500	.094	.064	.0644	—	—
Y6-4	.500	.281	.062	.032	.0229	—	—
Y6-7	.750	.500	.125	.040	.0459	—	—
Y6-8	.750	.625	.094	.051	.0649	—	—
Y6-9	.750	.625	.094	.064	.0804	—	—
Y6-10	.750	.625	.188	.032	.0402	—	—
Y6-11	.750	.625	.188	.040	.0498	—	—
Y6-14	.812	.688	.125	.064	.0876	—	
Y6-15	.781	.250	.125	.040	.0372	—	—
Y6-16	.812	.875	.125	.091	.1386	—	
Y6-17	1.000	.750	.094	.081	.1305	—	
Y6-18	1.000	.750	.188	.125	.1897	—	
Y6-19	1.000	.750	.125	.102	.1604	—	
Y6-20	1.000	.750	.188	.032	.0522	—	—
Y6-21	1.000	.750	.188	.040	.0648	—	—
Y6-22	1.000	.750	.188	.051	.0820	—	—
Y6-23	1.000	.750	.188	.064	.1019	—	—
Y6-24	1.000	.750	.188	.072	.1139	—	—
Y6-26	1.000	.750	.094	.072	.1168	—	—
Y6-27	1.125	.625	.062	.064	.1053	—	—
Y6-28	1.250	.750	.125	.051	.0961	—	—
Y6-31	1.250	.750	.188	.040	.0748	—	—
Y6-32	1.250	.750	.188	.051	.0947	—	—
Y6-33	1.250	.750	.188	.064	.1179	—	—
Y6-35	1.250	.750	.188	.081	.1475	—	—
Y6-36	1.250	.750	.188	.091	.1646	—	—
Y6-37	1.250	.750	.094	.081	.1508	—	—
Y6-38	1.250	.750	.062	.064	.1213	—	—
Y6-41	1.250	1.000	.188	.040	.0848	—	—
Y6-43	1.250	1.000	.188	.064	.1339	—	—
Y6-44	1.250	1.000	.188	.072	.1499	—	—
Y6-45	1.250	1.000	.188	.081	.1678	—	
Y6-46	1.250	1.000	.188	.091	.1874	—	—
Y6-47	1.250	1.000	.156	.125	.2539	—	
Y6-48	1.250	1.000	.250	.125	.2489	—	

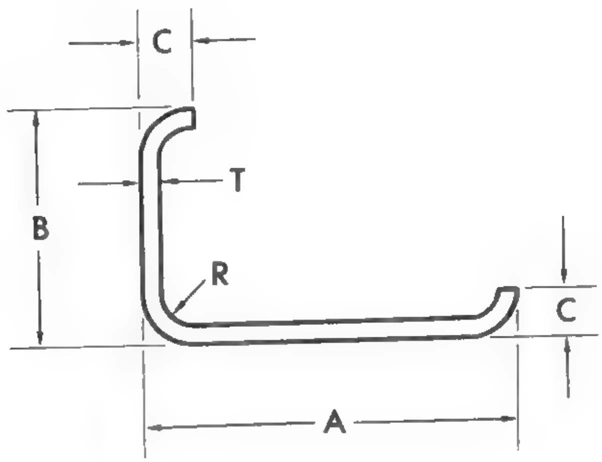
Figure 8-18. Angle 90°—Unequal Leg (Sheet 1 of 2)



1766-2SR

Number	A	B	R	T	Area	75ST	24ST
Y6-51	1.375	.812	.125	.072	.1473	—	
Y6-52	.875	.625	.094	.072	.0989	—	—
Y6-53	.875	.625	.125	.051	.0706	—	—
Y6-55	1.000	.625	.094	.051	.0777	—	—
Y6-57	1.000	.750	.125	.072	.1158	—	—
Y6-61	1.500	.750	.188	.052	.1075	—	—
Y6-66	1.000	.750	.156	.125	.1914	—	
Y6-67	1.500	1.000	.062	.064	.1533	—	—
Y6-72	1.500	1.000	.188	.064	.1499	—	—
Y6-74	1.500	1.000	.188	.081	.1880	—	—
Y6-75	1.500	1.000	.188	.091	.2101	—	—
Y6-77	1.500	1.000	.125	.102	.2369	—	—
Y6-82	1.500	1.250	.188	.064	.1659	—	—
Y6-84	1.500	1.250	.188	.091	.2329	—	
Y6-95	1.562	.750	.125	.064	.1396	—	—
Y6-97	1.688	.750	.125	.064	.1476	—	—
Y6-100	1.750	1.000	.188	.040	.1048	—	—
Y6-105	1.750	1.000	.094	.064	.1684	—	—
Y6-106	1.250	.750	.094	.091	.1692	—	
Y6-107	1.750	1.000	.094	.091	.2365	—	
Y6-115	1.750	1.000	.188	.092	.2329	—	—
Y6-117	1.750	1.250	.188	.081	.2285	—	
Y6-125	1.750	1.500	.125	.102	.3134	—	
Y6-135	1.750	1.125	.094	.072	.1978	—	
Y6-136	1.500	1.000	.125	.091	.2126	—	
Y6-137	1.500	1.250	.188	.125	.3148	—	
Y6-146	2.000	.750	.125	.064	.1676	—	—
Y6-196	2.500	1.000	.125	.064	.2156	—	—
Y6-197	2.625	1.750	.125	.072	.3048	—	
3-10805-11	7.50	.625	.060	.020	.0265	—	
3-10805-13	.750	.625	.060	.030	.0394	—	
3-10805-17	.625	.500	.060	.030	.0318	—	
3-10805-23	.750	.625	.090	.062	.0781	—	

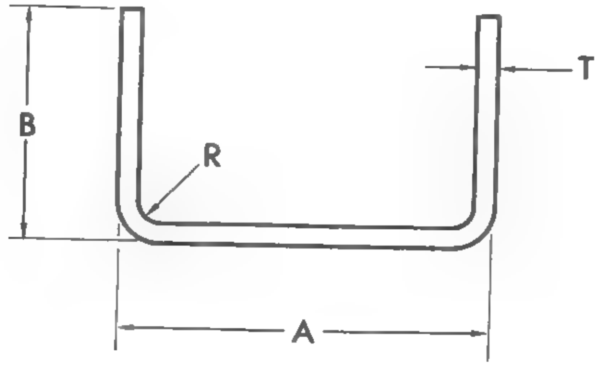
Figure 8-18. Angle 90°—Unequal Leg (Sheet 2 of 2)



Number	A	B	C	R	T	Area	75ST	24ST
Y7-21	1.000	.750	.188	.125	.040	.0727	—	—
Y7-22	1.000	.750	.188	.125	.051	.0907	—	
Y7-23	1.000	.750	.188	.125	.064	.1108	—	
Y7-27	1.000	.875	.219	.125	.072	.1361	—	
Y7-28	1.000	.875	.188	.125	.064	.1188	—	
Y7-30	1.000	.875	.188	.125	.051	.0971	—	
Y7-36	1.250	.875	.188	.125	.051	.1098	—	
Y7-37	1.250	.875	.188	.125	.064	.1348	—	
Y7-38	1.250	.875	.219	.125	.072	.1541	—	
Y7-39	1.250	.875	.219	.125	.081	.1707	—	
Y7-42	1.250	1.000	.188	.125	.051	.1162	—	
Y7-43	1.250	1.000	.188	.125	.064	.1428	—	
Y7-45	1.250	1.000	.219	.125	.081	.1808	—	
Y7-74	1.500	1.000	.219	.125	.081	.1873	—	

1767-SR

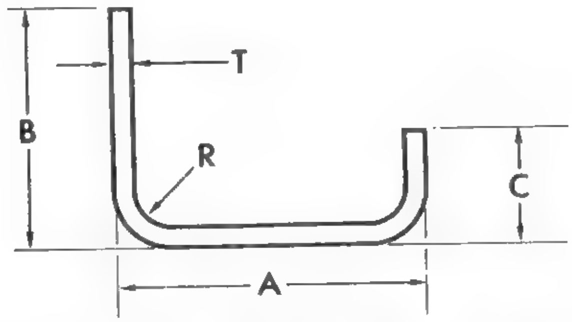
Figure 8-19. Angle 90°—Unequal Leg—Flanged



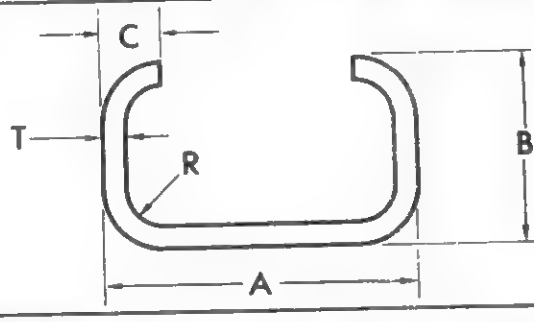
Number	A	B	R	T	Area	75ST	24ST
Y10-18	.750	.250	.062	.020	.0230		—
Y10-20	.750	.250	.094	.040	.0429	—	
Y10-27	.875	.625	.062	.064	.1226		—
Y10-42	1.000	.531	.062	.032	.0618	—	—
Y10-44	1.000	.625	.062	.040	.0840	—	—
Y10-47	1.000	.688	.062	.064	.1386	—	—
Y10-48	1.031	.312	.062	.051	.0754		—
Y10-50	1.000	1.062	.125	.125	.3393	—	
Y10-54	1.094	.750	.062	.072	.1703	—	—
Y10-56	1.250	.750	.062	.040	.1040	—	—
Y10-58	1.250	.750	.062	.051	.1312	—	—
Y10-59	1.250	1.000	.062	.040	.1240	—	—
Y10-63	1.375	.750	.062	.040	.1090	—	
Y10-65	1.375	.750	.062	.064	.1706	—	—
Y10-67	1.375	1.000	.062	.051	.1631	—	—
Y10-68	1.500	.344	.125	.040	.0793	—	
Y10-69	1.500	.750	.062	.040	.1140	—	—
Y10-71	1.500	.344	.062	.064	.1786	—	—
Y10-75	1.500	.750	.188	.102	.2643	—	—
Y10-77	1.500	1.250	.125	.064	.2392	—	
Y10-80	1.750	.750	.062	.051	.1567	—	—
Y10-89	2.000	.750	.062	.040	.1340	—	—
Y10-90	2.000	.750	.062	.051	.1694	—	—
Y10-110	2.500	.755	.062	.051	.1949	—	—
Y10-117	2.750	1.312	.125	.081	.4107	—	
Y10-128	3.000	.750	.125	.040	.1718	—	—
Y10-168	4.000	.750	.062	.051	.2714	—	—
Y10-174	4.000	1.000	.125	.064	.3672	—	
3-10807-7	5.00	.380	.060	.020	.0232	—	—
3-10807-9	.562	.440	.060	.030	.0268	—	
3-14933-7	1.000	.800	.090	.040	.138	—	

1768-SR

Figure 8-20. Channel—Plain



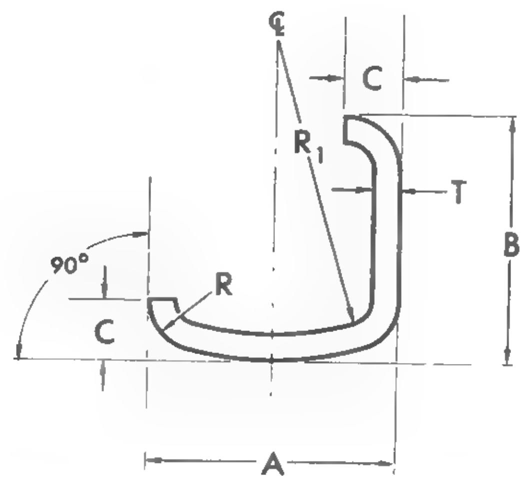
Number	A	B	C	R	T	Area	75ST	24ST
Y11-24	1.094	1.250	.688	.062	.072	.2018		—
Y11-42	1.500	1.500	1.250	.188	.064	.2518		—



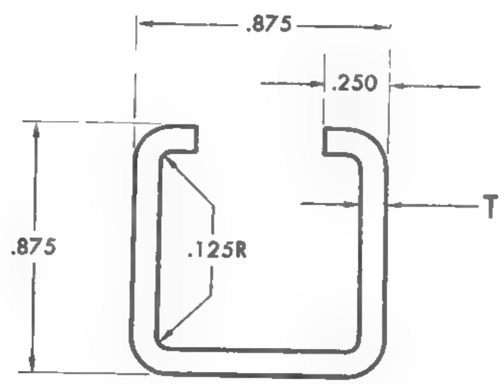
Number	A	B	C	R	T	Area	75ST	24ST
Y12-4	.750	.750	.175	.062	.040	.0920	—	
Y12-16	1.250	.750	.188	.125	.051	.1358	—	—
Y12-17	1.250	.750	.188	.125	.064	.1674	—	
Y12-25	1.250	.750	.188	.125	.040	.1187		—
Y12-26	1.500	.750	.188	.125	.051	.1486	—	—
Y12-28	1.500	.750	.250	.125	.072	.2114		—
Y12-30	1.500	.812	.219	.125	.091	.2645	—	
Y12-32	1.500	1.125	.219	.125	.051	.1868	—	
Y12-33	1.500	1.125	.188	.125	.064	.2304	—	—
Y12-35	1.500	1.125	.219	.125	.081	.2900	—	
Y12-36	1.500	1.125	.219	.125	.091	.3213	—	
Y12-37	1.500	1.125	.219	.125	.102	.3547	—	
Y12-42	2.000	1.500	.188	.125	.064	.3104	—	—
Y12-46	2.000	1.500	.375	.250	.125	.5892	—	
Y12-48	2.188	1.156	.188	.094	.072	.3141	—	—
Y12-50	2.500	1.000	.188	.125	.040	.1786	—	—
Y12-51	3.000	1.000	.250	.125	.081	.3962	—	
Y12-54	4.000	.656	.219	.125	.040	.2136	—	
3-10806-7	.600	.562	.080	.060	.016	.0269	—	—
3-10806-9	.600	.562	.080	.060	.020	.0339	—	
3-10806-11	.625	.625	.090	.060	.020	.0371	—	
3-10806-13	.750	.500	.130	.060	.020	.0362	—	
3-10806-15	1.000	.500	.130	.060	.020	.0412	—	
3-10806-17	.750	.500	.130	.060	.016	.0279	—	

1769-SR

Figure 8-21. Y11—Channel—Unequal Leg
Y12—Channel—Flanged



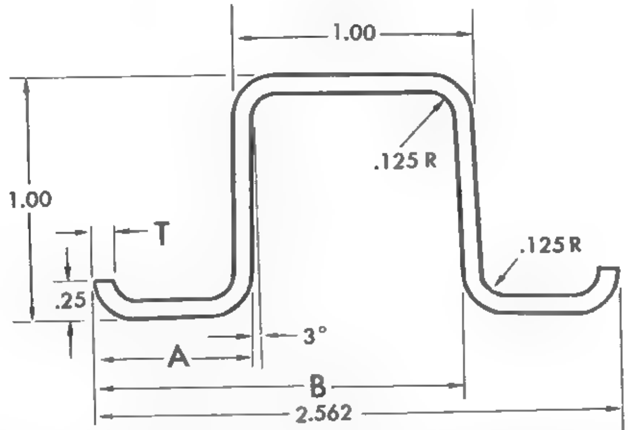
Number	A	B	C	R	R1	T	Area	75ST	24ST
Y13-1	.870	.812	.188	.189	1.000	.032	.0555	—	
Y13-2	.870	.812	.188	.189	1.000	.051	.0907	—	
Y13-3	.870	.812	.188	.189	1.000	.064	.1111	—	
Y13-4	.870	.812	.188	.189	1.000	.040	.0705	—	
Y13-5	1.000	.850	.280	.250	1.000	.064	.1480	—	
Y13-6	1.000	.850	.280	.250	1.000	.072	.1670	—	
Y13-7	1.000	.850	.280	.250	1.000	.081	.1850	—	
Y13-8	1.000	.850	.280	.250	1.000	.091	.2110	—	
Y13-9	1.000	.850	.280	.250	1.000	.102	.2350	—	



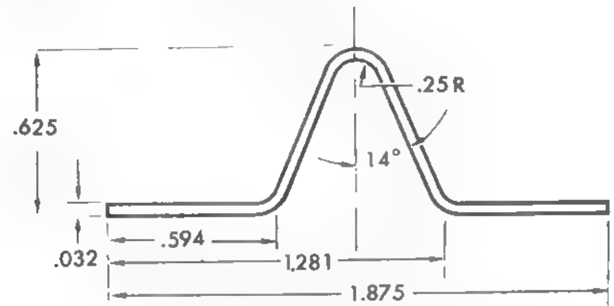
Number	T	Area	75ST	24ST
Y14-16	.032	.0881		—
Y14-17	.040	.1087	—	
Y14-18	.051	.1361		—

1770-SR

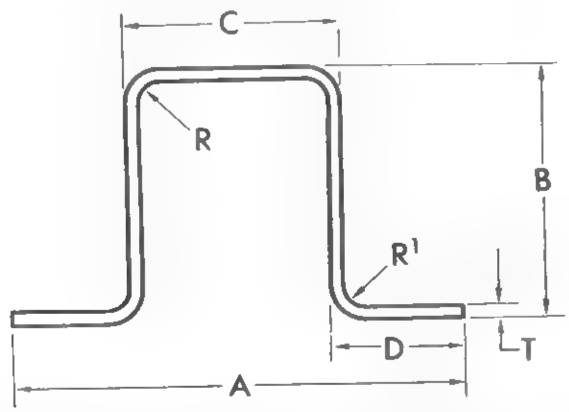
Figure 8-22. Y13—Angle—Curved Leg—Flanged
Y14—Channel—Square—Flanged



Number	A	B	T	Area	75ST	24ST
Y20-46	.761	1.801	.040	.1706		—
Y20-47	.780	1.782	.051	.1828	—	



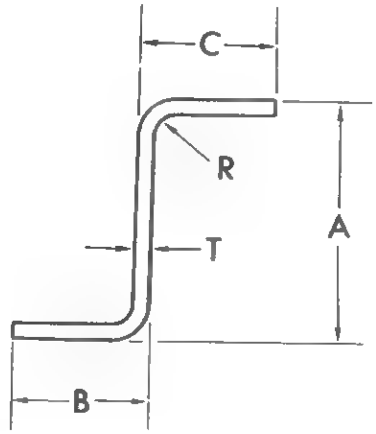
Number	Area	24ST
Y31-5	.0844	—



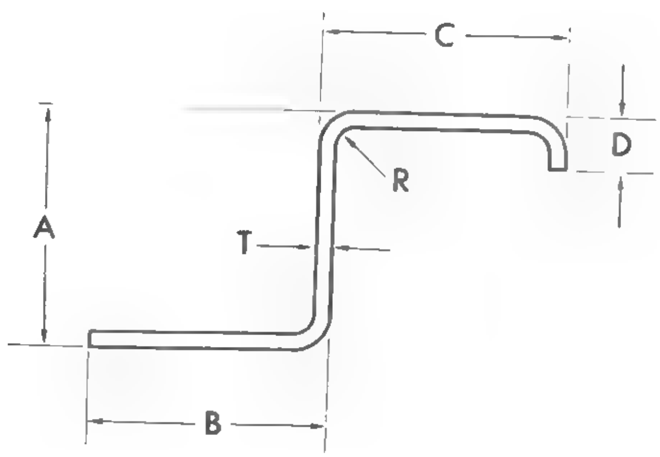
Number	A	B	C	D	R	R_1	T	Area	75ST	24ST
Y32-10	1.750	.500	.750	.500	.125	.125	.064	.1506	—	—
Y32-12	1.875	1.062	.781	.547	.094	.094	.040	.1490	—	
Y32-14	2.000	1.000	.750	.625	.094	.125	.064	.2323	—	

1771-1SR

Figure 8-23. Y20—Hat—Rectangular—Flanged
Y31—Hat—Pyramid—Plain
Y32—Hat—Rectangular—Plain



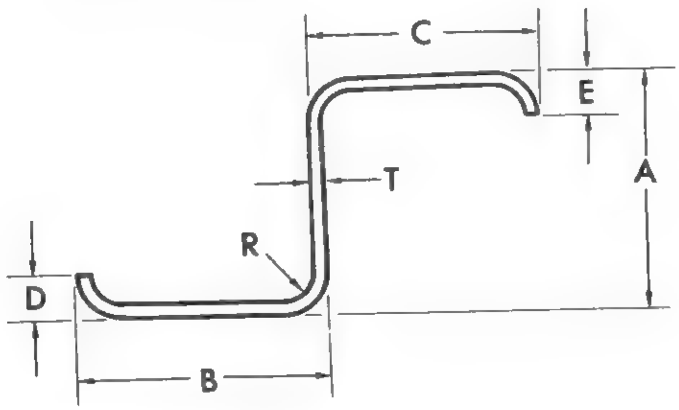
Number	A	B	C	R	T	Area	75ST	24ST
Y33-50	1.250	.750	.625	.094	.032	.0789	—	—
Y33-55	1.500	.875	.875	.125	.051	.1541	—	—
3-13964-7	1.250	.500	.500	.090	.040	.0840	—	



Number	A	B	C	D	R	T	Area	75ST	24ST
Y34-70	.750	.938	.625	.188	.062	.051	.1132	—	
3-16841-7	1.500	1.000	1.000	.312	.160	.102	.326	—	

1771-2SR

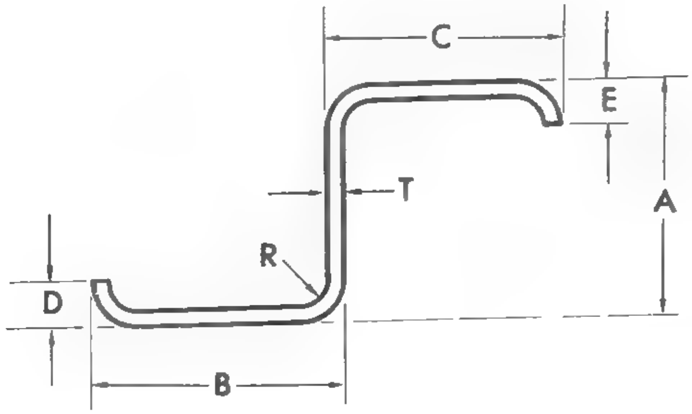
Figure 8-24. Y33—"Z"—Plain
Y34—"Z"—One Leg Flanged



1772-1 SR

Number	A	B	C	D	E	R	T	Area	75ST	24ST
Y36-5	.875	.625	.625	.188	.188	.062	.040	.0879	—	
Y36-7	.875	.625	.625	.188	.188	.062	.051	.1094	—	
Y36-9	.875	.625	.625	.188	.188	.062	.064	.1332	—	
Y36-13	.750	.625	.625	.188	.188	.062	.032	.0676	—	—
Y36-15	.750	.625	.625	.188	.188	.062	.051	.1031	—	—
Y36-17	1.000	.688	.688	.188	.188	.062	.032	.0798	—	
Y36-18	1.000	.688	.688	.188	.188	.062	.040	.0979	—	
Y36-19	1.000	.688	.688	.188	.188	.062	.051	.1221	—	—
Y36-21	1.000	.688	.688	.188	.188	.062	.064	.1492	—	
Y36-27	1.000	.875	.875	.188	.188	.094	.072	.1884	—	
Y36-28	1.125	.812	.812	.188	.188	.094	.072	.1882	—	
Y36-29	1.125	.812	.812	.219	.219	.094	.064	.1738	—	—
Y36-38	1.250	.875	.875	.219	.219	.094	.051	.1513	—	
Y36-39	1.250	.875	.875	.219	.219	.094	.064	.1898	—	—
Y36-40	1.250	.875	.875	.188	.188	.094	.081	.2285	—	
Y36-41	1.250	.875	.875	.219	.219	.094	.072	.2107	—	
Y36-42	1.375	.875	.875	.375	.375	.156	.102	.3173	—	
Y36-43	1.500	.688	.688	.188	.188	.062	.051	.1478	—	
Y36-46	1.500	.625	.625	.156	.156	.062	.032	.0896	—	
Y36-47	1.500	.688	.812	.312	.188	.062	.040	.1280	—	
Y36-48	1.500	.812	.812	.188	.188	.062	.040	.1279	—	—
Y36-49	1.500	.812	.812	.188	.188	.062	.051	.1603	—	
Y36-50	1.500	.812	.812	.219	.219	.094	.064	.1978	—	—
Y36-51	1.500	.812	.812	.188	.188	.094	.072	.2152	—	
Y36-52	1.500	.812	.812	.250	.250	.125	.091	.2701	—	
Y36-53	1.500	1.000	1.000	.312	.312	.125	.081	.2936	—	
Y36-54	1.500	1.000	1.000	.312	.312	.188	.125	.3995	—	
Y36-70	2.000	.812	.812	.188	.188	.094	.040	.1485	—	
Y36-71	2.000	.812	.812	.188	.188	.094	.051	.1832	—	
Y36-72	2.000	.812	.812	.219	.219	.094	.064	.2298	—	
Y36-73	2.000	.812	.812	.219	.219	.094	.072	.2557	—	
Y36-79	2.000	1.000	1.000	.250	.250	.094	.072	.2872	—	

Figure 8-25. Y36—"Z"—Flanged (Sheet 1 of 2)

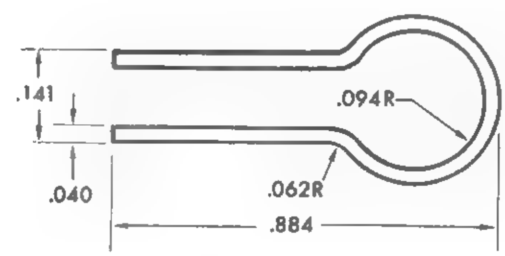


Number	A	B	C	D	E	R	T	Area	75ST	24ST
Y36-80	2.000	1.000	1.000	.375	.375	.125	.081	.3355	—	
Y36-81	2.000	1.000	1.000	.375	.375	.125	.091	.3725	—	
Y36-82	2.000	1.000	1.000	.375	.375	.156	.102	.4066	—	
Y36-83	2.000	1.125	1.125	.375	.375	.188	.125	.5082	—	
Y36-94	2.250	1.000	1.000	.250	.250	.125	.051	.2187	—	
Y36-95	2.250	1.000	1.000	.250	.250	.125	.064	.2704	—	
Y36-121	3.125	1.000	1.000	.188	.188	.094	.064	.3218	—	

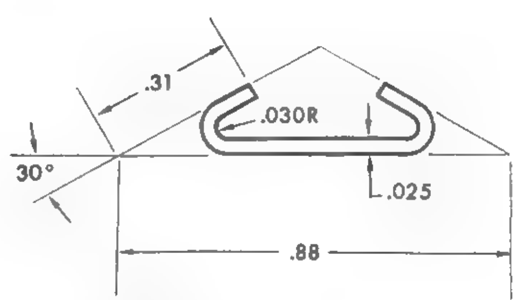
1772-2 SR

Figure 8-25. Y36—"Z"—Flanged (Sheet 2 of 2)

NUMBER	AREA	75ST
Y50-12	.076	—

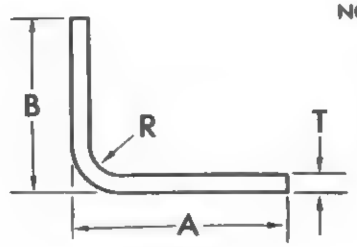


NUMBER	AREA	24ST
3-16870-7	.022	—



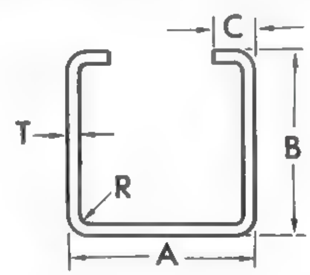
1773-SR

Figure 8-26. Y50—Finish Strip—Bulb Type
3-16870—Finish Strip—Channel

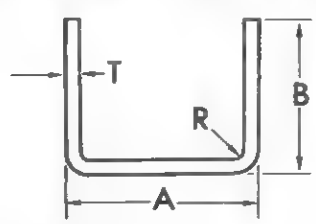


NOTE: THESE MEMBERS ARE FORMED FROM TYPE 301 CORROSION RESISTANT STEEL, 1/4 HARD. MIL-S-5059

Number	A	B	R	T	Area
3-10805-7	.500	.500	.060	.016	.0153
-9	.500	.500	.060	.020	.0190
-11	.625	.750	.060	.020	.0265
-13	.625	.750	.060	.030	.0394
-15	.500	.500	.060	.030	.0281
-17	.500	.625	.060	.030	.0318
-19	.625	.625	.060	.030	.0356
-21	.625	.625	.090	.062	.0704
-23	.625	.750	.090	.062	.0781



Number	A	B	C	R	T	Area
3-10806-7	.600	.562	.080	.060	.016	.0269
-9	.600	.562	.080	.060	.020	.0339
-11	.625	.625	.090	.060	.020	.0371
-13	.750	.500	.130	.060	.020	.0362
-15	1.000	.500	.130	.060	.020	.0412
-17	.750	.500	.130	.060	.016	.0279



Number	A	B	R	T	Area
3-10807-7	.500	.380	.060	.020	.0232
-9	.562	.440	.060	.030	.0268

1795-SR

Figure 8-27. Corrosion Resistant Steel Formed Members

APPENDIX I
REPAIR MATERIALS

A-1. ADHESIVES. (See table A-I.) These adhesives are used for bonding metal to metal or to various other materials such as phenolic or polyester type sheet. Epoxy type adhesives listed under MIL-A-8623 are permanent adhesives. EC833 is a rubber base adhesive and may be removed with petroleum or alcohol base solvents.

Table A-I. Adhesives

DESIGNATION	SPECIFICATION	CHARACTERISTICS AND USE
EPON VI	MIL-A-8623(Aer) Type I	Room temperature setting. 20 - 30°C (68 - 86°F)
EPON VI or VIII	MIL-A-8623(Aer) Type II	Intermediate temperature setting. 31 - 99°C (87 - 210°F)
EPON VIII	MIL-A-8623(Aer) Type III	High temperature setting. Above 99°C (210°F)
EC833	MIL-T-10168(QMC)	Room temperature setting. Attaching Generco to cargo floor.
EPON 3119	Narmco Manufacturing Corp	Room temperature setting. Metal Putty.

A-2. CORROSION INHIBITORS. (See Table A-II.) These materials are used as corrosion inhibitors for aluminum alloys and are applied before priming.

Table A-II. Corrosion Inhibitors

DESIGNATION	SPECIFICATION	APPLICATION
Chemical Film.	MIL-C-303	
Chromic Acid.	(Federal) O-C-303	10% solution with water.

A-3. FASTENERS.

A-4. BOLTS. (See Table A-III.) The following is general practice information. Always use the same type and material bolts for replacement. Use a nut of the same material as the bolt. Use close tolerance bolts in shear installations. Use drilled shank bolts with castle nuts. Use undrilled shank bolts with self-locking nuts.

Table A-III. Bolts

DESIGNATION	MATERIAL	IDENTIFICATION	USE
AN3 to AN20	Steel—Cad plated.	Raised X on head.	Ordinary installations.
AN3C to AN20C	Corrosion resistant steel.	Raised - on head.	High temperature installations.

Table A-III. Bolts (Cont.)

DESIGNATION	MATERIAL	IDENTIFICATION	USE
AN3DD to AN20DD	Aluminum alloy, anodized.	Two raised radial -.	Use only as replacement for aluminum.
AN173 to 186	Steel—Cad plated close tolerance.	Raised triangle and x.	Shear installations.
NAS144 to 186 and NAS172 to 178	High tensile strength steel.	Internal wrenching head.	Tension installations with high strength nuts only.
NAS333 to NAS340	100° countersunk head. High tensile strength steel, cad plated. Close tolerance.	Number and triangle on head.	Shear installations with standard nuts. May be substituted for Huck lockbolts.
NAS464	High tensile strength steel. Close tolerance.	Number and triangle on head.	High shear installations with standard nuts.
NAS495	High tensile and fatigue strength steel.	Internal wrenching head. Smaller wrench size than NAS144. Number on head.	Tension installations with high strength nuts only. 10% stronger than NAS 144 series.

A-5. NUTS. (See Table A-IV.) Following is general practice information. Use nuts of the same material as the bolt. Use castle nuts with drilled shank bolts only. Use self-locking nuts with undrilled shank bolts only. Use plain nuts as jam nuts only. Use shear nuts where bolts are in shear load only. Use high strength nuts with all internal wrenching bolts. Aluminum nuts may be identified by weight. Corrosion resistant steel nuts may be identified with a magnet. High temperature corrosion resistant low ferrous steel nuts are identified by the letter "H" and are non-magnetic.

Table A-IV. Nuts

DESIGNATION	TYPE	MATERIAL USAGE AND VENDOR
AN310	Castle	Steel, aluminum or CRES
AN316	Plain	Steel or CRES
AN320	Shear castle	Steel, aluminum or CRES
AN361	Plate nut—Self-locking	Countersunk or CRES
AN362	Plate nut—Self-locking	Not countersunk, CRES
AN364	Shear Self-locking	Steel, aluminum or CRES
AN365	Self-locking	Steel, aluminum or CRES
AN366	Plate nut—Self-locking	Countersunk, steel or aluminum
AN373	Plate nut—Self-locking	Not countersunk. Steel or aluminum.
4600-211	Dome type plate nut	Fuel-tight. Vendor—Nutshell
22G1	Gang channel	Steel nuts. Vendor—ESNA
EB-048 to -164	12 point wrenching	High strength steel—self-locking. Vendor—ESNA

A-6. SCREWS. (See Table A-V.) Do not use low strength steel screws in structural installations. Screws listed below are identified by an X on the head, indicating 125,000 to 145,000 psi tensile strength steel.

Table A-V. Screws

DESIGNATION	HEAD TYPE
AN502	Fillester head—drilled
AN509	100° countersunk head
NAS220 to 227	Brazier head
NAS514	100° countersunk head. Same as AN509 except for full threaded shank.

A-7. WASHERS. (See Table A-VI.) Use regular or thin washers as needed. The letter "L" added to AN960 callout indicates a thin washer. Use CRES washers with CRES bolts and nuts only. Identify by being non-magnetic. Use hard aluminum washers only for dissimilar metal insulation. Do not use aluminum washers with internal wrenching bolts except when called out on the print or as a replacement for aluminum washer.

Table A-VI. Washers

DESIGNATION	MATERIAL	TYPE AND USE
AN960	Steel	Plain—Ordinary installations.
AN960C	CRES	Plain—High temperature installations.
AN960D	Aluminum	Plain—Insulation purposes.
NAS143	Steel	Plain—Under high strength nuts.
NAS143C	Steel	Countersunk. Use with countersunk face against head of internal wrenching bolts.

A-8. RIVETS. (See Table A-VII.) Refer to paragraph 1-47 for fastener usage and substitution.

Table A-VII. Rivets

DESIGNATION	MATERIAL	SHANK DIAMETERS
AN426B and AN470B	56S	−3 to −6
AN426AD and AN470AD	A17S	−3 to −6
AN426D and AN470D	17S	−3 to −10
AN426TA and AN470TA	17ST	−3 to −8
AN426DD and AN470DD	24S	−4 to −12
CR156C cherry blind (AF462B)	56S	−4 to −6
CR157C cherry blind (AF463B)	56S	−4 to −6
CR563 cherry blind	Monel	−4
Q4304 100° countersunk head	CRES (Convair Spec. 0-01006)	−3 to −10
Q4310 flat head		−3 to −10
Hi-Shear rivets. See figure 1-18. Equivalent of NAS177 and 178	Steel	−6 to −12
Huck lockbolts. See figure 1-20. Huck Manufacturing Co	Steel	−6 to −12

A-9. FINISHES. (See Table A-VIII.)

Table A-VIII. Finishes

DESIGNATION	PURPOSE	SPECIFICATION	THINNER
Wash Primer	Prime base	MIL-P-15328 (ships)	50% Isopropyl alcohol 50% Butyl alcohol
Vinyl zinc chromate	Primer	MIL-P-15930 (ships)	10% Toluene 90% Methyl
Amercoat No. 33	Interior green topcoat	Amercoat Corp. Standard color No. 611	Isobutyl Ketone
Vinyl Alkyd Enamel	Exterior topcoat glossy sea blue Standard color No. 623	MIL-P-15936 (ships)	Blush retardant lacquer thinner, Specification MIL-P-6095
Paint Stripper		Navy 52R15	

A-10. FIBERGLAS. (See Table A-IX.) Parts referred to in this manual as fiberglas are of two types. They may be identified by location and color.

Table A-IX. Fiberglas

DESIGNATION	BONDING	IDENTIFICATION	USE	VENDOR
Sheet 0.0312 gage	Phenolic	Brown	Fairing Insulator	Angelus Aircraft Co
Sheet, Honeycomb	Polyester	Neutral, Translucent	Antenna Covers	Narmco Manufacturing Co

A-11. FLOOR COVERING. (See Table A-X.) All repair of floor covering will consist of replacement of panels.

Table A-X. Floor Covering

DESIGNATION	MATERIAL	VENDOR
Durug	Color 305 Beige 20 oz/yd Grain No. 11	Durecote Corporation, Ravena, Ohio
Generco	Phenolic bonded, paper base, rigid sheet. Textured	General Veneer Co, South Gate, California

A-12. FLOOR PANELS. (See Table A-XI.) Panels used on these airplanes are metallic honeycomb core sandwich type complying with Convair Specification ZM-393C.

Table A-XI. Floor Panels

THICKNESS PANEL	MATERIAL FACE	FACE GAGE	
		UPPER	LOWER
0.63 inch	75ST Alclad	0.020	0.020
0.63 inch	24ST Alclad	0.020	0.020
0.63 inch	24ST Alclad	0.020	0.032

A-13. SEALING MATERIALS. (See Table A-XII.) Materials used in fuel, water and airtighting. Their purpose and handling information are included in this table.

Table A-XII. Sealing Materials

DESIGNATION	SPECIFICATION OR VENDOR	PERTINENT INFORMATION
Alumilastic CB	Par Paint & Color Co	Caulking windows.
EC612	MIL-S-7126A	Substitute for Alumilastic.
EC776	MIL-S-4383	Cementing synthetic rubber to metal. Colored with red aniline dye and used as a fueltight sealer.
EC801	AF14153	Void Sealer. Used in fuel and airtighting. Must be mixed with an accelerator specified by the manufacturer. Unless otherwise specified, use accelerator EC807. Proportions 12 parts EC807 to 100 parts EC801, by weight. Active work life, 2 to 3 hrs. at 80°F. May be refrigerated to keep mixed material usable for several days.
EC807		Accelerator for EC801.
EC1137	Minnesota Mining & Manufacturing Co	High temperature element caulking as in leading edge and firewalls.
Fueltight Caulking Compound		3 parts EC801, 5 parts ground rubber (fairprene 5570). Proportions by volume.
Fairprene Sheet 5570	E. I. DuPont de Nemours & Co, Inc	0.032 inch gage. Fueltight gaskets.
Ground rubber		Made by grinding scrap fairprene on a sanding disc and screening through a flour sifter.
Seal Washers 4018A	Los Angeles Standard Rubber Co	Used on Huck lockbolts and AN bolts in fueltight installations.
Solvent (MEK) Methyl Ethyl Ketone	TT-M-261-2	Solvent and cleaner for fueltighting materials. Will strip paint with prolonged application.
Zinc Chromate Tape	NAVAER S-149	Used in water and airtighting in hull and floats.
Zinc Chromate Paste	AF3596-1	Void sealer for water and airtighting.
Kelite Bubble Fluid No. 26	Aviation Lubricants and Supplies Co	For detecting leaks when air pressure testing. Soapy water may be used for this purpose.
EC1293	Minnesota Mining & Manufacturing Co	Sealing rubber to metal. EC1291 is an interchangeable substitute for EC1293 (high temperature sealing compound).
Paralketone	MIL-C-16173, Type I	Prevents corrosion.
Zinc Chromate Primer	MIL-P-6889A (Yellow)	Used to reduce consistency of paralketone.
Thinner	TTT548 Toluene	Used with zinc chromate primer to reduce consistency of paralketone.

A-14. STRUCTURAL MATERIALS. (See Table A-XIII.) Refer to Section I for characteristics, tempers and substitution.

Table A-XIII. Structural Materials

DESIGNATION	SPECIFICATION	PERTINENT INFORMATION
ALUMINUM ALLOY BAR STOCK		
2S	QQ-A-411	Use only for non-structural fillers, fueltighting seal plugs.
75S-T6	QQ-A-277(T6)	Sizes up to 6 x 6 inch—use for fitting and extrusion substitutes.
ALUMINUM ALLOY EXTRUDED SHAPES		
24S-T4	QQ-A-267(T4)	See figures 8-1 to 8-13.
75S-T6	QQ-A-277(T6)	
Magnesium Alloy	MIL-M-5354	See figure 8-13.
ALUMINUM ALLOY FORMED MEMBERS		
24S-T3 clad	QQ-A-362(T3)	See figures 8-15 to 8-27.
75S-T6 clad	QQ-A-287(T6)	
ALUMINUM ALLOY SHEET STOCK		
24S-T3 clad	QQ-A-362(T3)	0.016 to 0.125 gage.
61S-T3 clad	QQ-A-327(T3)	0.032 to 0.064 gage (weldable).
75S-T6 clad	QQ-A-287(T6)	0.016 to 0.250 gage.
CHROME MOLYBDENUM SHEET STEEL		
4130	AN-QQ-S-685N	0.020 to 0.125 gage.
CORROSION RESISTANT STEEL SHEET AND FORMED MEMBERS		
Type 301, ¼ H	MIL-S-5059, Comp 301, ¼ H	0.008 to 0.064 gage. See figure 8-28.
Type 301, ½ H	MIL-S-5059, Comp 301, ½ H	0.008 to 0.064.
Type 302, Annealed	MIL-S-5059, Comp 302, Annealed	0.008 to 0.064.
Type 347	MIL-S-6721	0.016 to 0.064 (weldable).

A-15. SODIUM HYDROXIDE. Specification O-S-60S. 10% solution with water used to check if scratches have penetrated the clad layer on 24S and 75S alclad.

A-16. TEMPLAQ, 162.7°C (325°F). Vendor, Tempil Corporation, New York, New York. Used to check temperature when hot dimpling 75S-T6. Refer to paragraph 1-55. No substitute recommended.

APPENDIX II

TYPICAL REPAIRS

B-1. GENERAL. Repairs which are applicable to more than one section of this manual are grouped in this appendix. By the application of principles established in Section I and illustrated in this section, it is possible to design repairs for a large portion of the structure of these airplanes. In most instances damage to structure will require a combination of two or more described repairs. Some of the repairs illustrated are already combinations. A careful study of the actual damage will indicate which of the illustrated principles can be applied. Repairs beyond the scope of this manual will require engineering action.

B-2. SKIN REPAIRS. Figure B-1 illustrates the difference between flush and over patches and the factors affecting selection of the type best suited for a specific repair. These repairs are designed to return the full working strength of the skin or web member.

B-3. STRUCTURAL MEMBER REPAIRS. Figures B-2 and B-3 illustrate splices of various extruded and formed members. They are designed using formulas and tables found in Section I of this manual.

B-4. FLANGED MEMBER REPAIRS. Figures B-4, B-5 and B-6 illustrate repairs to flanged members with varying degrees of damage. These repairs are illustrated in principle only and rivet count must be determined by application of formulas and tables found in Section I.

B-5. CRACKED DIMPLE REPAIRS. Figures B-7 and B-8 illustrate approved repairs for cracked dimples in 24ST and 75ST members in gages of 0.040 inch and under. Members of heavier gage will require application of formulas found in Section I.

B-6. TRAILING EDGE REPAIR. Figure B-9 illustrates a trailing edge repair applicable to the components listed. This is a combination repair in which the rivet count in the spar repair is determined by formulas and tables in Section I. The rivet count and pattern in the skin repair may be determined by the existing pattern used in original attachment. The rivet information indicated for the trailing edge cap may be applied to all trailing edge caps, both aluminum and fiberglas. This repair applied to control or tab surfaces will require a check of control balance.

B-7. LEADING EDGE REPAIR. Figure B-10 is classed as a permanent field repair of the thermal anti-ice leading edge as it completely returns the functional ability of the leading edge and conventional rivets are used. Figures B-11 and B-12 illustrate repairs classed as temporary because they do not completely return the functional ability of the anti-icing system and employ blind rivets. (See table 1-XI for values of substitution of rivets for spotwelds.) These repairs are applicable to both wing and tail leading edges.

B-8. CORROSION RESISTANT STEEL LEADING EDGE RIB REPAIR. Figure B-13 illustrates two repairs and a replacement. Any member may be replaced using corrosion resistant steel rivets in place of spotwelds, diameter to be determined from table 1-XI. Rivet count to be used in splicing members of gages and dimensions other than those shown in this illustration will require engineering action.

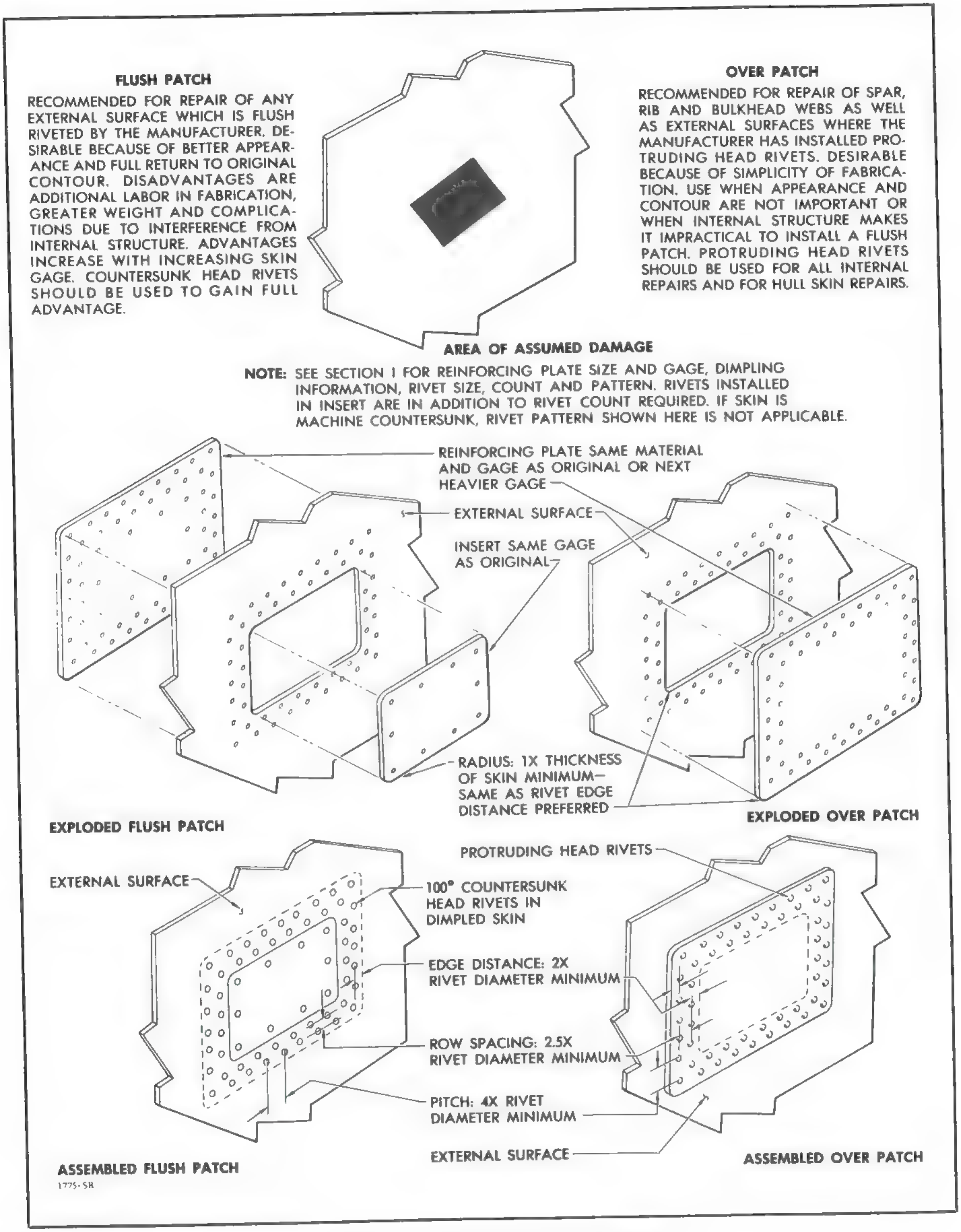
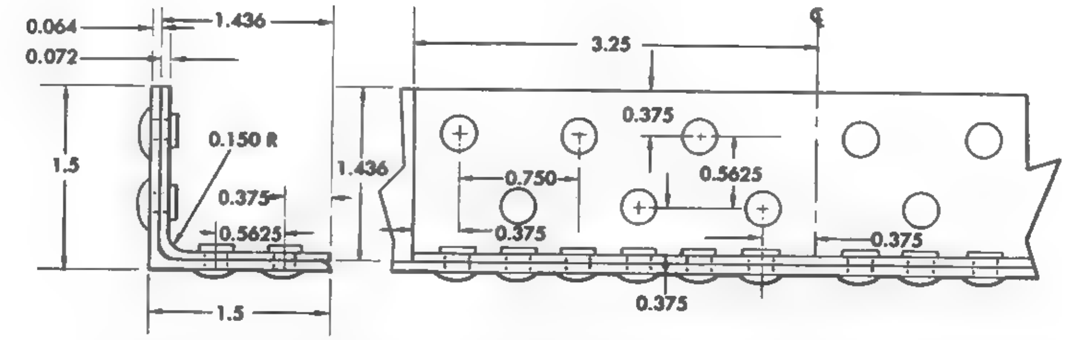
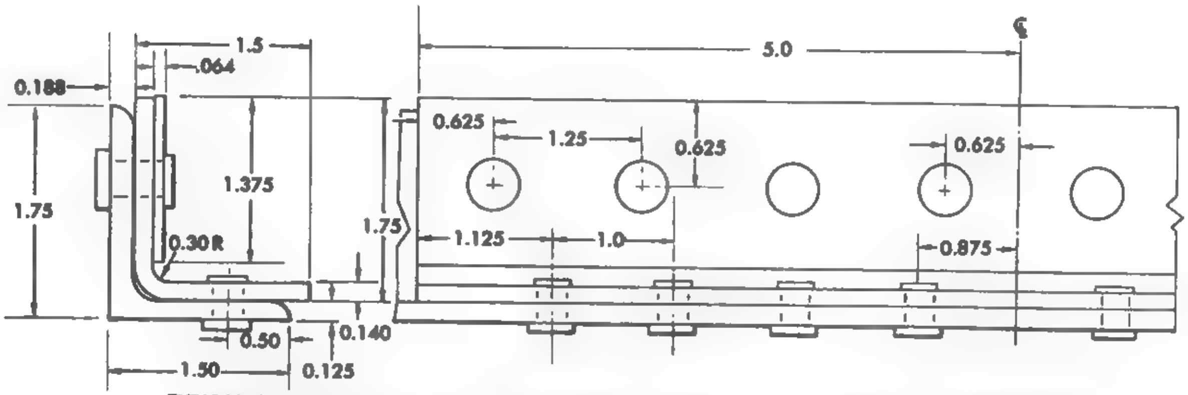


Figure B-1. Typical Stressed Plating Repairs



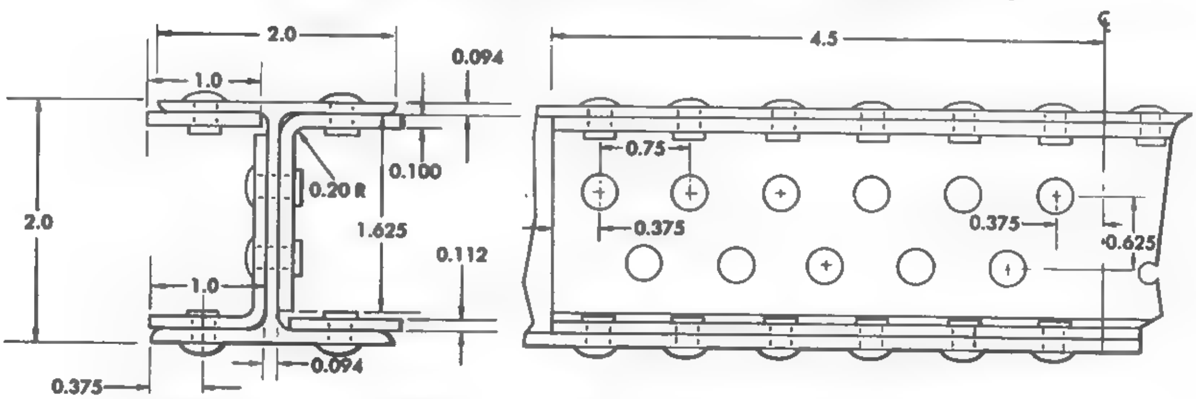
TYPICAL SPLICE OF EXTRUDED ANGLE HAVING EQUAL FLANGE WIDTH AND THICKNESS

EXTRUDED MEMBER AND10133-1404 MATERIAL 75ST AREA 0.191
SPLICE ANGLE FORMED FROM 75 SW SHEET ALCLAD AREA 0.206
RIVETS USED AN470TA6. TOTAL RIVET COUNT USED = 24



TYPICAL SPLICE OF EXTRUDED ANGLE HAVING UNEQUAL FLANGE WIDTH AND THICKNESS

EXTRUDED MEMBER K59105 MATERIAL 75ST AREA 0.498
SPLICE ANGLE FORMED FROM 75SW SHEET ALCLAD
DOUBLER 75ST SHEET ALCLAD. COMBINED AREA 0.543
RIVETS USED IN HEAVY FLANGE Q4310C10 TOTAL COUNT = 8
RIVETS USED IN LIGHT FLANGE Q4310C8 TOTAL COUNT = 8

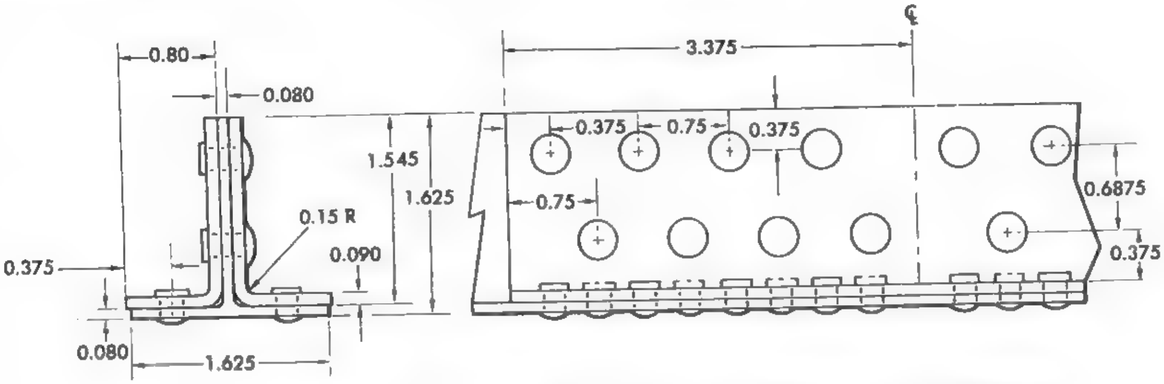


TYPICAL SPLICE OF EXTRUDED "I" HAVING EQUAL FLANGE WIDTH AND THICKNESS

EXTRUDED MEMBER AND10140-2001 MATERIAL 75ST AREA 0.552
SPLICE ANGLES (2) FORMED FROM 75SW SHEET ALCLAD
FLAT STRIPS (2) 75ST SHEET ALCLAD. COMBINED AREA 0.740
RIVETS USED AN470TA6. TOTAL RIVET COUNT USED = 70

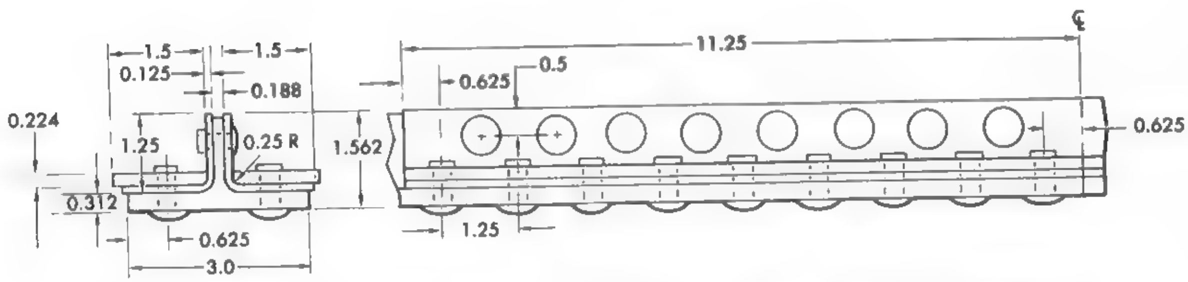
1784-SR

Figure B-2. Typical Extruded Member Splices (Sheet 1 of 2)



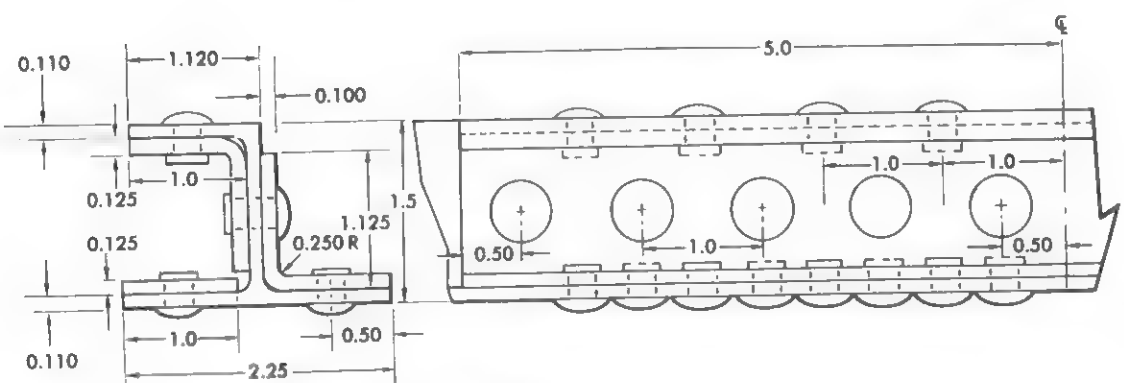
TYPICAL SPLICE OF EXTRUDED "T" HAVING EQUAL FLANGE WIDTH AND THICKNESS

EXTRUDED MEMBER HM14345 MATERIAL 75ST AREA 0.257
SPLICE ANGLES (2) FORMED FROM 75SW SHEET ALCLAD. AREA 0.275
RIVETS USED AN470TA6. TOTAL RIVET COUNT USED = 32



TYPICAL SPLICE OF EXTRUDED "T" HAVING UNEQUAL FLANGE WIDTH AND THICKNESS

EXTRUDED MEMBER K37281 MATERIAL 75ST AREA 1.179
SPLICE ANGLES (2) FORMED FROM 75SW SHEET ALCLAD
DOUBLERS 75ST SHEET ALCLAD. COMBINED AREA 1.330
RIVETS USED IN LIGHT FLANGE AN470DD8. TOTAL COUNT = 16.
RIVETS USED IN HEAVY FLANGES AN470DD10. TOTAL COUNT = 36.

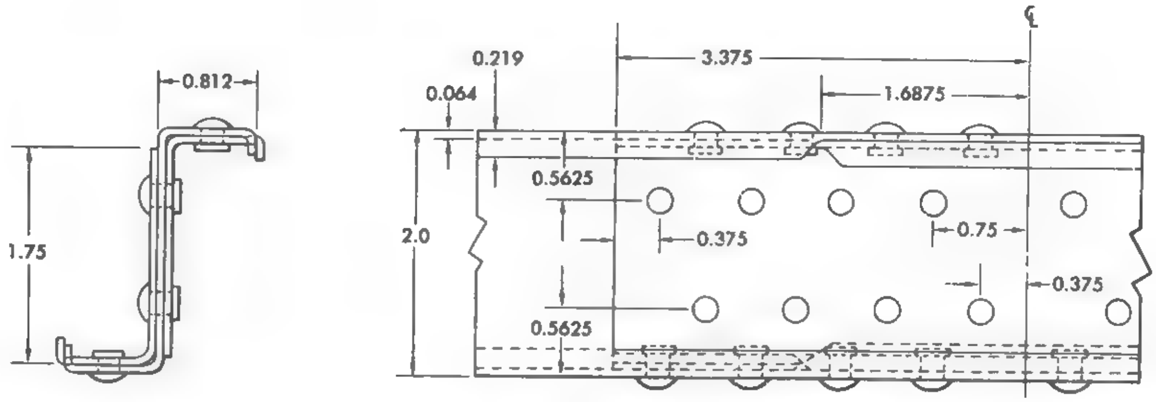


TYPICAL SPLICE OF EXTRUDED "T"

EXTRUDED MEMBER K59087 MATERIAL 75ST AREA 0.507
SPLICE ANGLES (2) FORMED FROM 75SW SHEET ALCLAD.
FLAT MEMBER 75ST SHEET ALCLAD. COMBINED AREA 0.625
RIVETS USED AN470DD8. TOTAL RIVET COUNT USED = 34.

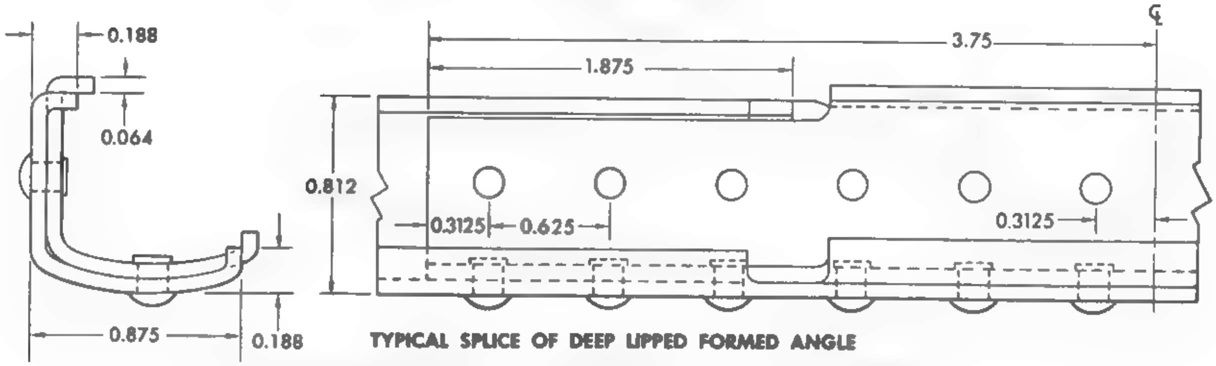
1786-SR

Figure B-2. Typical Extruded Member Splices (Sheet 2 of 2)



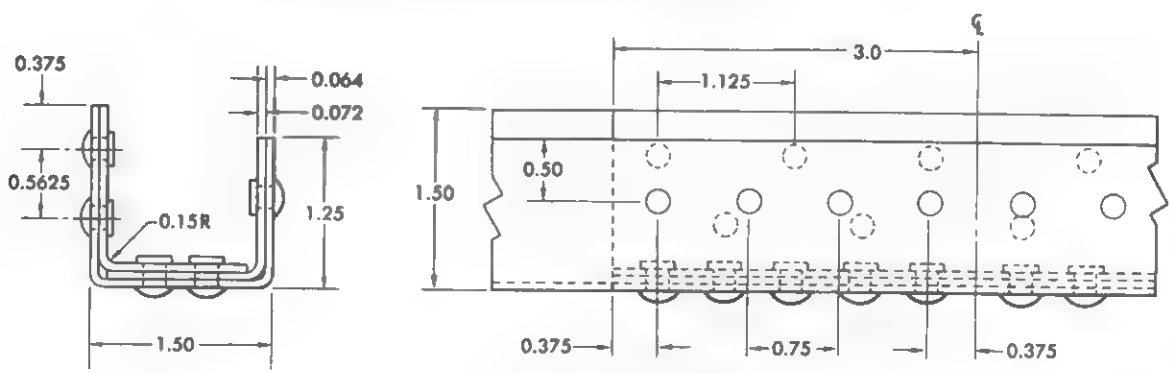
TYPICAL SPLICE OF DEEP LIPPED FORMED ZEE

FORMED MEMBER Y36-72 MATERIAL 75ST ALCLAD AREA 0.2292
SPLICE ANGLES MADE FROM Y36-72 MATERIAL SAME AREA 0.325
RIVETS USED AN470TA6 TOTAL RIVET COUNT USED = 32
REMOVE PART OF EACH LIP AS INDICATED.



TYPICAL SPLICE OF DEEP LIPPED FORMED ANGLE

FORMED MEMBER Y13-3 MATERIAL 75ST ALCLAD AREA 0.1111
SPLICE ANGLE SAME AS ORIGINAL
RIVETS USED AN470TA5 TOTAL RIVET COUNT USED = 24
REMOVE PART OF EACH LIP AS INDICATED.



TYPICAL SPLICE OF FORMED CHANNEL

FORMED MEMBER Y11-42 MATERIAL 24ST ALCLAD AREA 0.2518
SPLICE ANGLES FORMED FROM 24ST ALCLAD COMBINED AREA 0.365
RIVETS USED AN470TA6 TOTAL RIVET COUNT USED = 28

1793-SR

Figure B-3. Typical Formed Member Splices

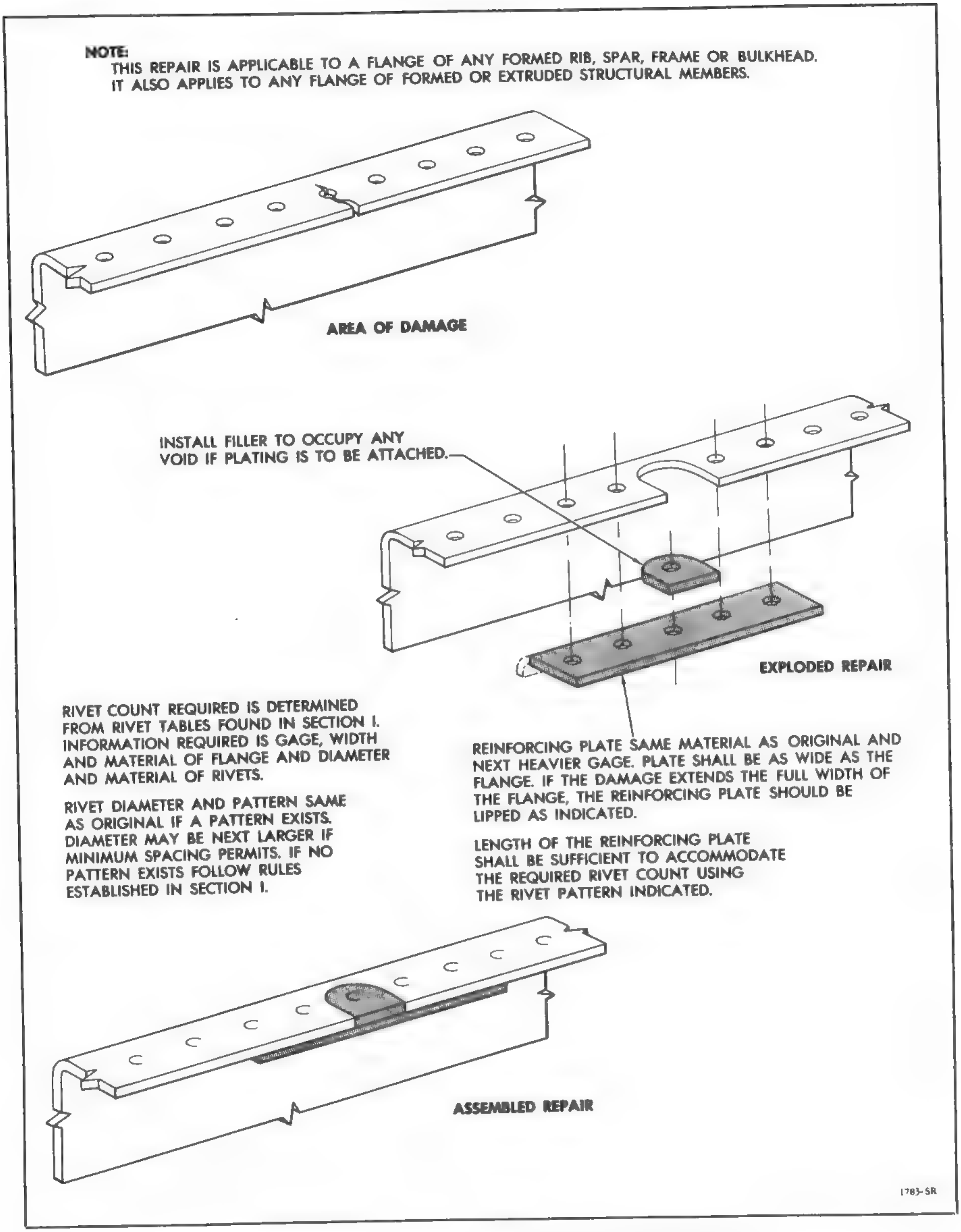


Figure B-4. Single Flange Repair—Rib or Structural Member

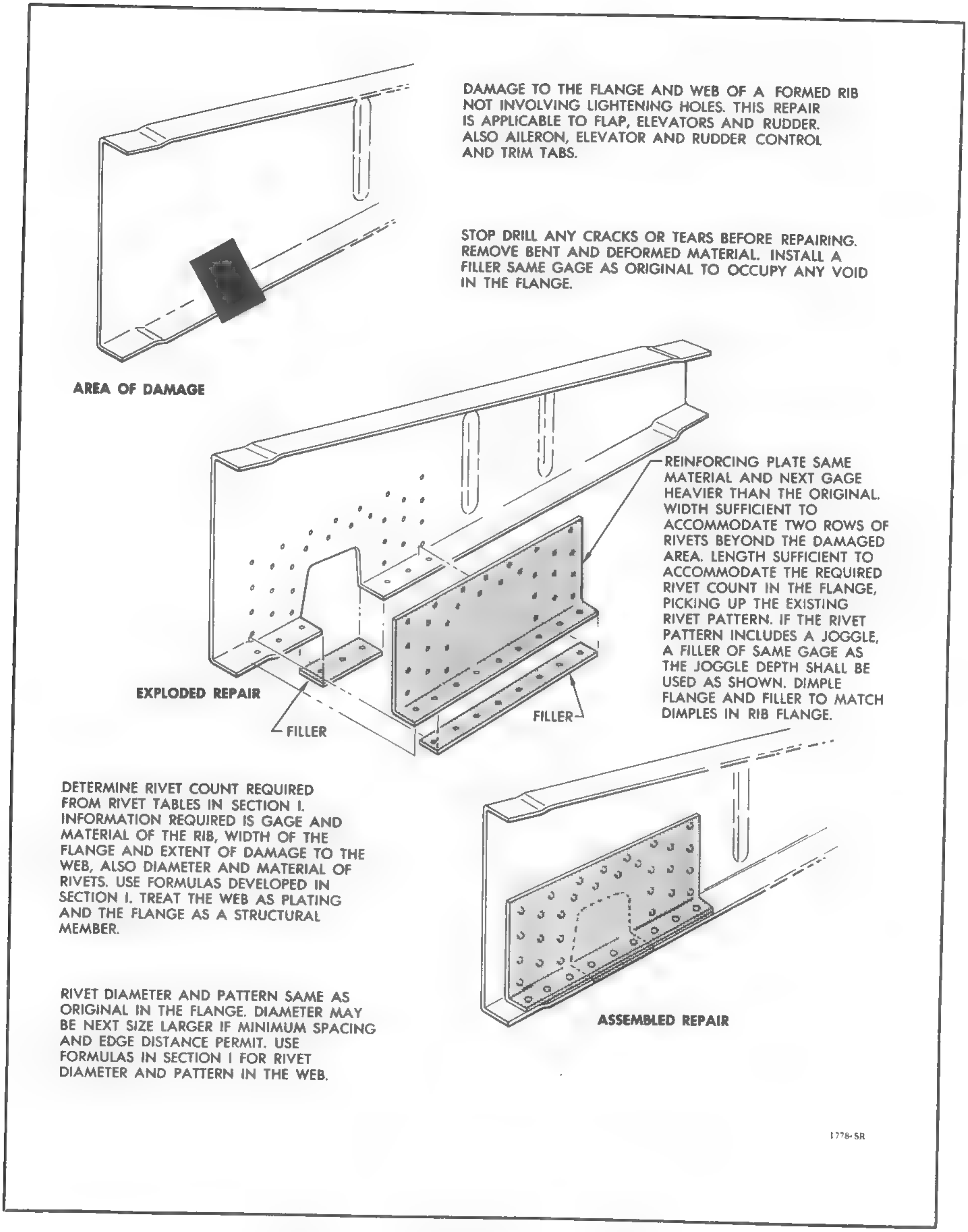
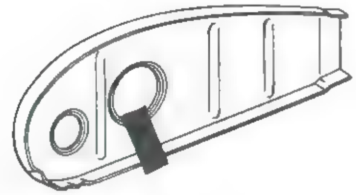


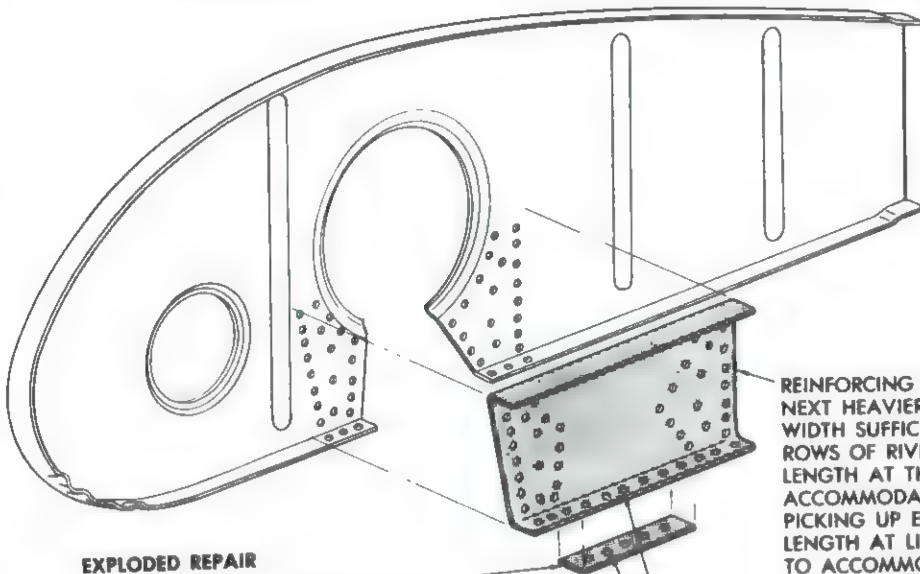
Figure B-5. Formed Rib Flange and Web Repair

THIS REPAIR IS APPLICABLE TO FLAP, RUDDER AND ELEVATOR RIBS.

REMOVE ANY DEFORMED MATERIAL AND STOP DRILL ANY CRACKS BEFORE REPAIR. INSTALL A FILLER OF SAME GAGE AS ORIGINAL TO OCCUPY ANY VOID IN THE FLANGE.



AREA OF DAMAGE



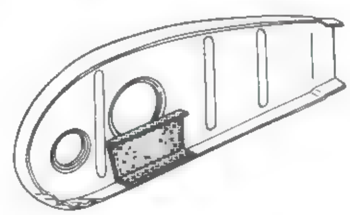
EXPLODED REPAIR

REINFORCING PLATE SAME MATERIAL AND NEXT HEAVIER GAGE THAN ORIGINAL. WIDTH SUFFICIENT TO ACCOMMODATE TWO ROWS OF RIVETS BEYOND DAMAGED AREA. LENGTH AT THE FLANGE SUFFICIENT TO ACCOMMODATE REQUIRED RIVET COUNT PICKING UP EXISTING RIVET PATTERN. LENGTH AT LIGHTENING HOLE SUFFICIENT TO ACCOMMODATE TWO ROWS OF RIVETS AT EACH SIDE. THE EDGE OF PLATE SHALL BE LIPPED WHERE CROSSING THE LIGHTENING HOLE. DEPTH OF LIP SAME AS DEPTH OF LIGHTENING HOLE FLANGE.

DIMPLE FLANGE AND FILLER TO MATCH DIMPLES IN RIB.

RIVET COUNT REQUIRED IS DETERMINED FROM RIVET TABLES FOUND IN SECTION I. INFORMATION REQUIRED IS GAGE AND MATERIAL OF RIB, WIDTH OF FLANGE, DEPTH FROM FLANGE TO LIGHTENING HOLE, RIVET DIAMETER AND MATERIAL. USE FORMULA AS DEVELOPED IN SECTION I AND ILLUSTRATED IN APPENDIX II FOR REPAIR OF AN ANGLE OF UNEQUAL FLANGE WIDTH. RIVETS INSTALLED ABOVE DAMAGED AREA ARE IN ADDITION TO RIVETS REQUIRED BY THIS FORMULA.

RIVET DIAMETER AND PATTERN SAME AS ORIGINAL IN THE FLANGE. DIAMETER MAY BE NEXT SIZE LARGER IF MINIMUM SPACING AND EDGE DISTANCE PERMIT. USE FORMULAS DEVELOPED IN SECTION I FOR RIVET DIAMETER AND PATTERN IN THE WEB.



ASSEMBLED REPAIR

1777-5R

Figure B-6. Flange and Web Repair at a Lightening Hole

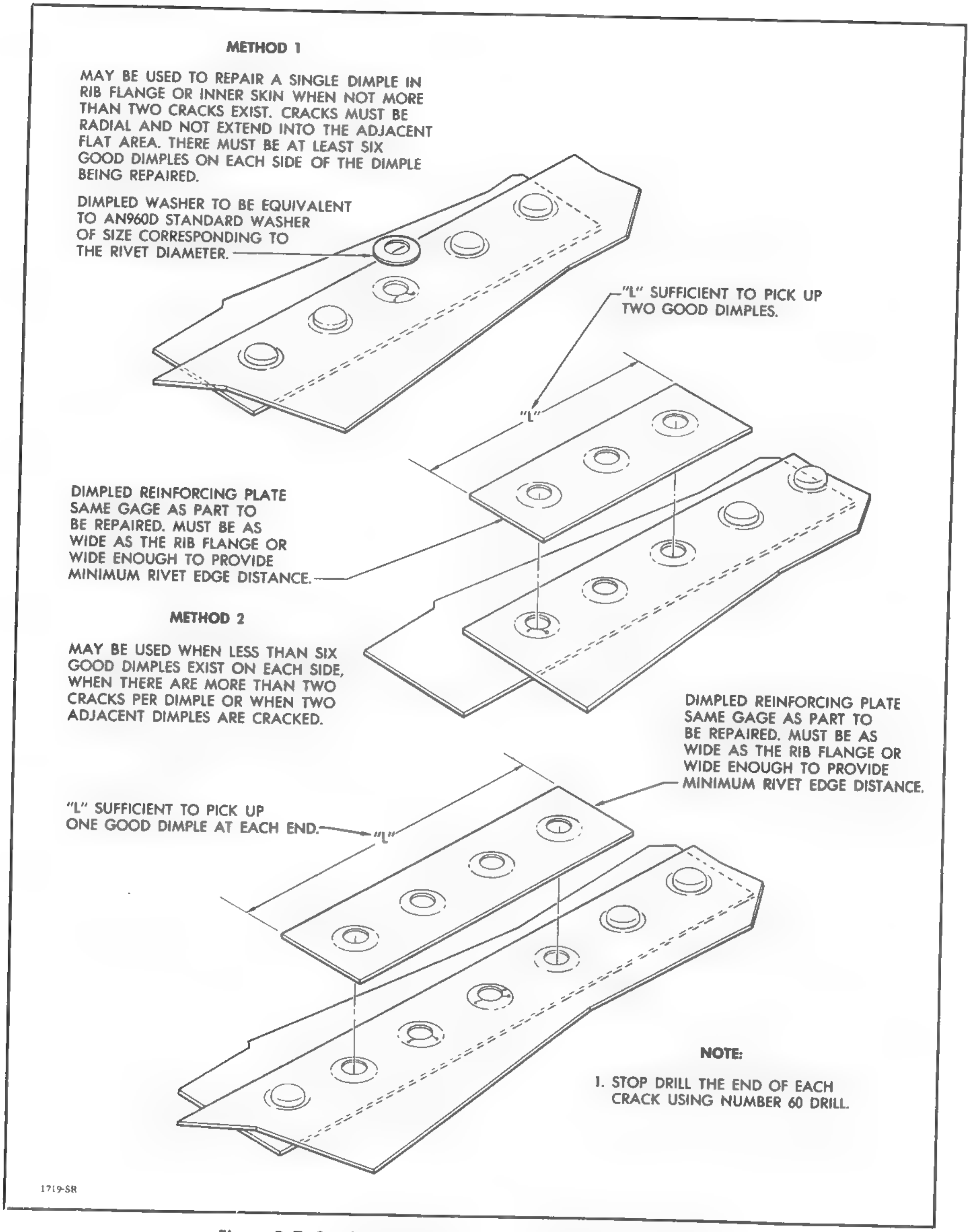


Figure B-7. Cracked Dimple Repairs—24ST Under 0.040 Gage

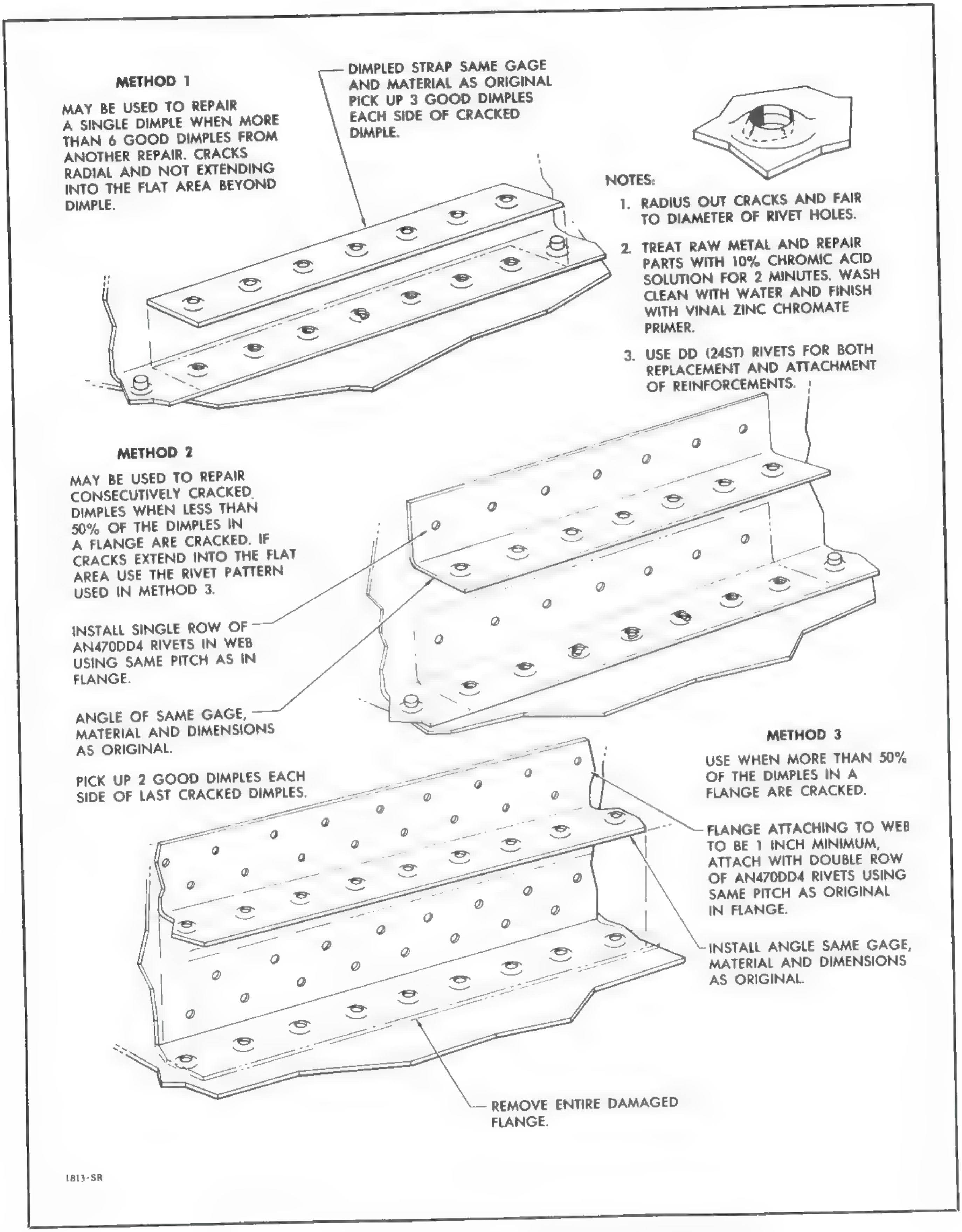


Figure B-8. Cracked Dimple Repairs—75ST Under 0.040 Gage

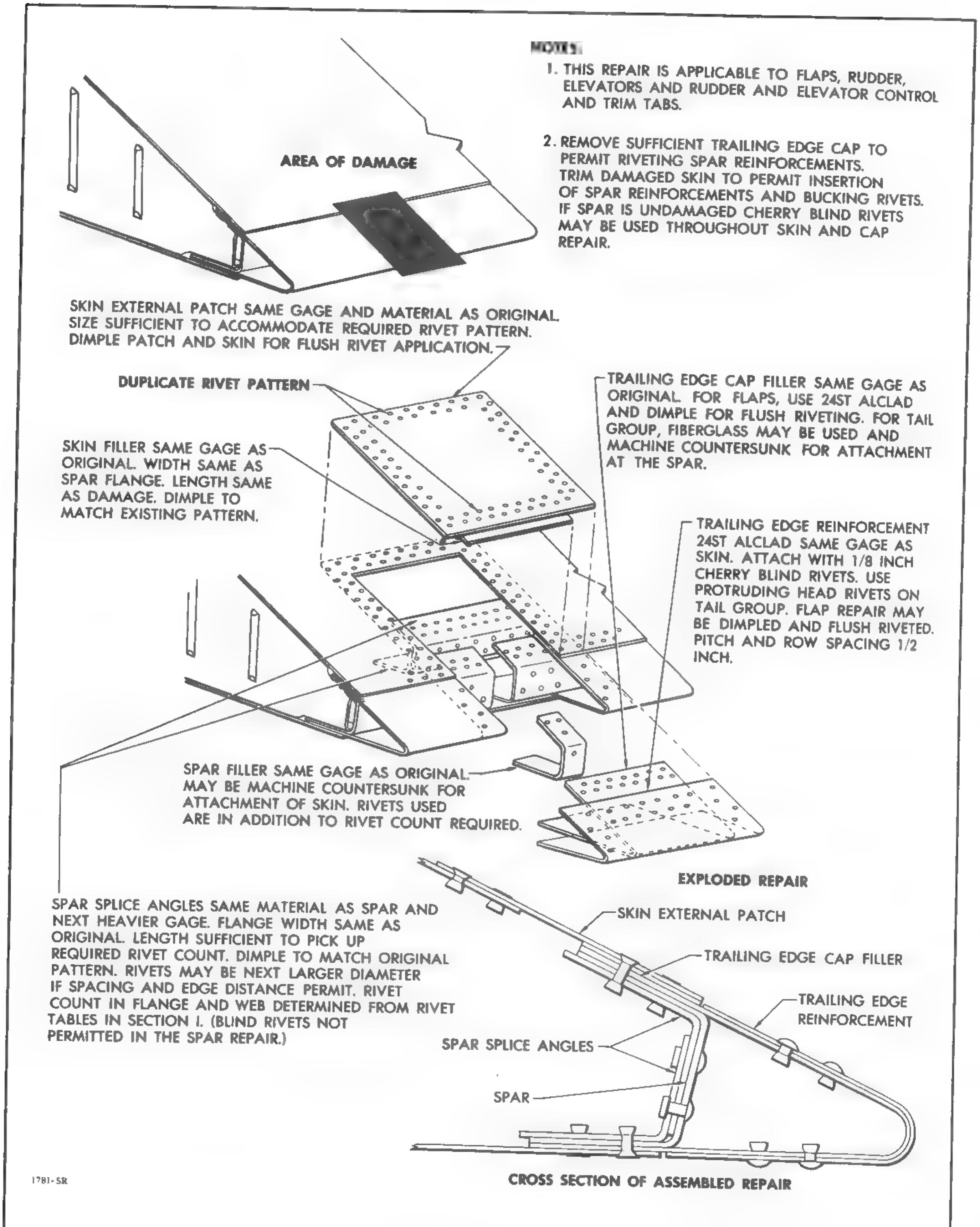


Figure B-9. Typical Trailing Edge Repair

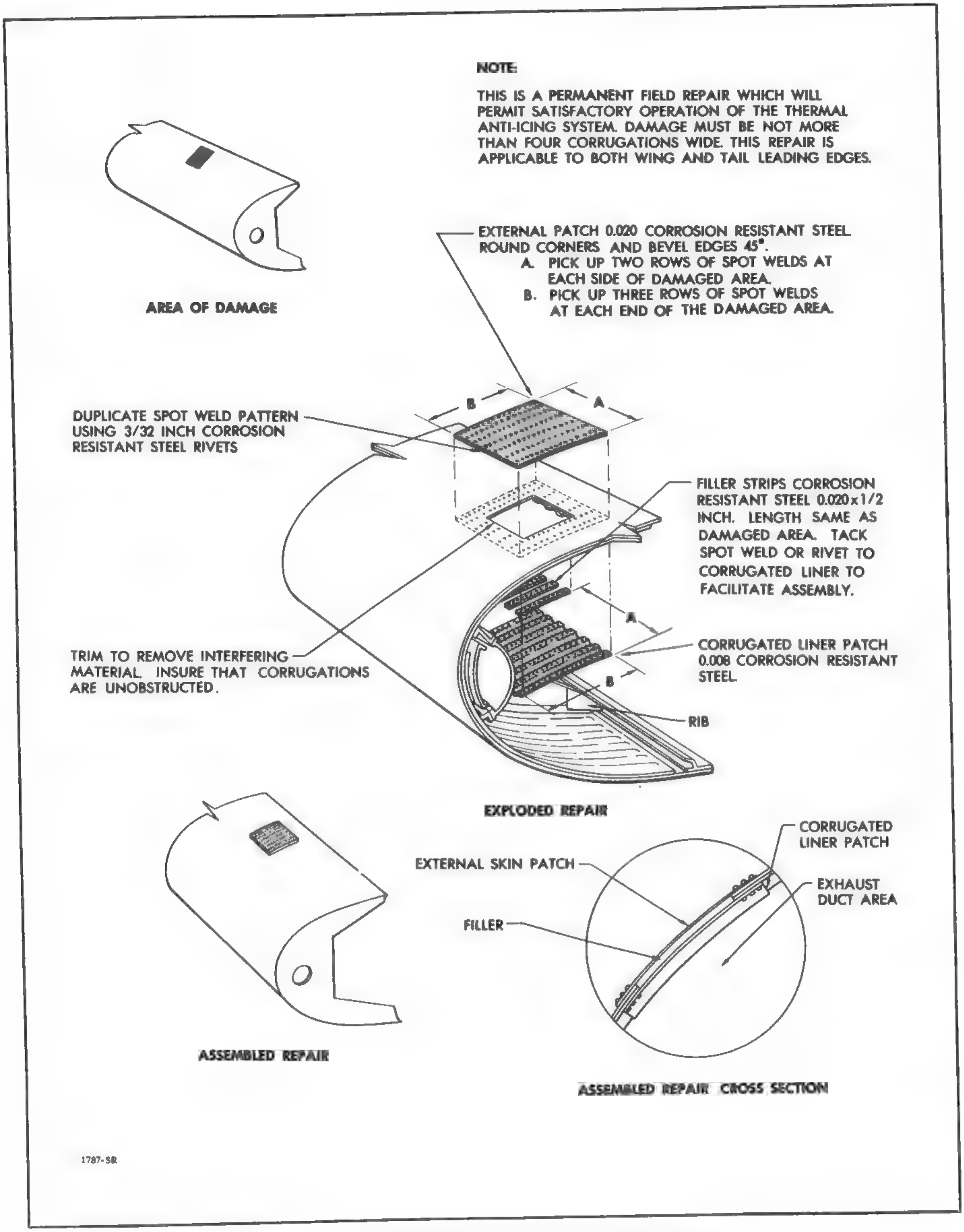


Figure B-10. Leading Edge Repair—Exhaust Duct Area

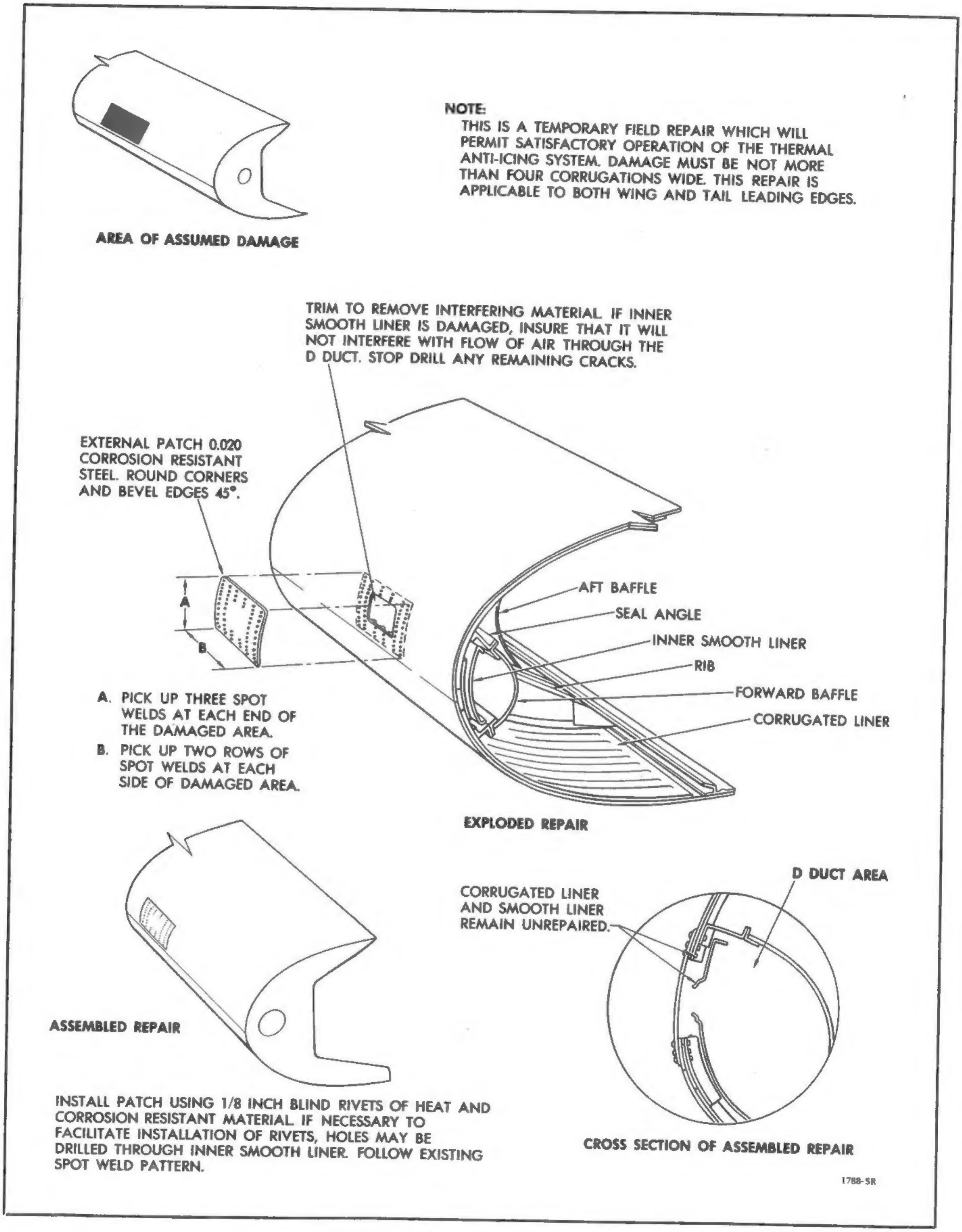


Figure B-11. Leading Edge Repair—"D" Duct Area

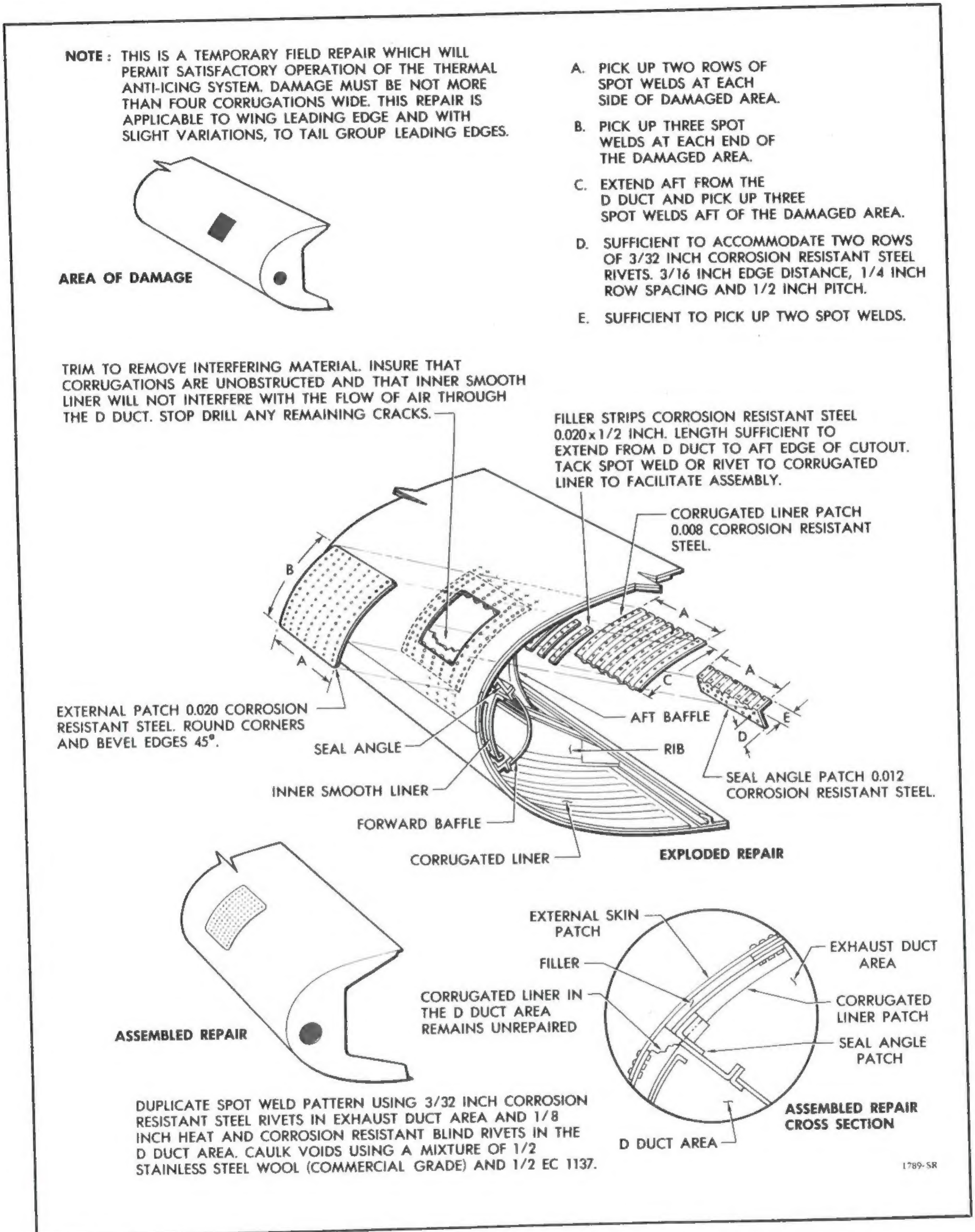


Figure B-12. Leading Edge Repair at the Forward Baffle

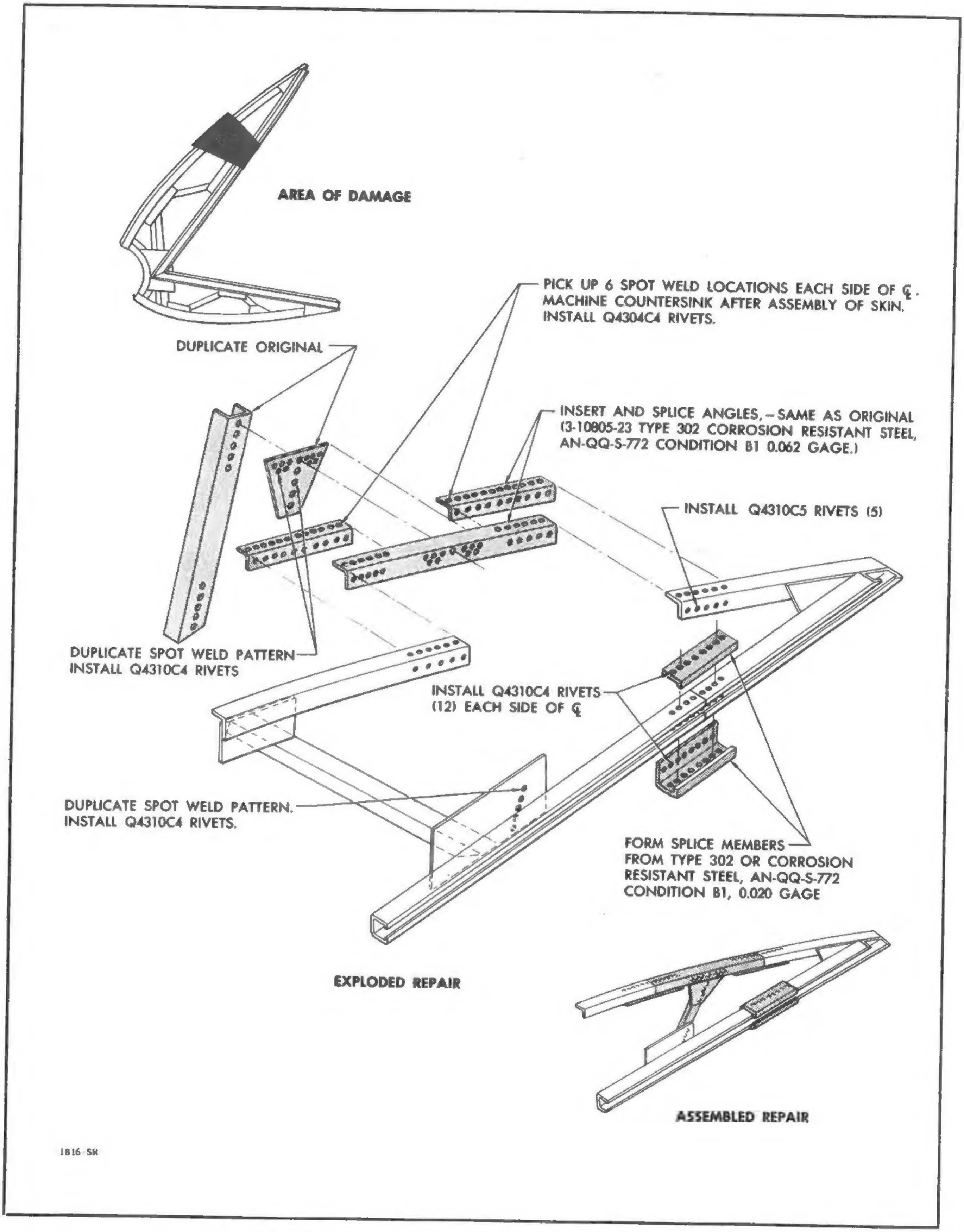


Figure B-13. Corrosion Resistant Steel Leading Edge Rib Repair

This page intentionally left blank

NAVY-CONVAIR — SAN DIEGO-LAL-1080 — 3-15-57